

THE VALUE OF VASOTOMY
IN
SEMINAL VESICULITIS.

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INTRODUCTION

History.

Gonorrhoea has afflicted man throughout the ages. The name was given by Galen, long before Linnæus and Hippocrates, however, the Jews formulated hygienic laws about the disease. Ancient Egyptian medical papyri mentioned by Herodotus gives a description of it, as does a Chinese manuscript dated 300 B.C.

I wish to express my indebtedness and gratitude to Dr R. C. L. BATCHELOR, and to Dr R. LEES, for allowing me to study and employ clinical material of the Venereal Diseases Department of the Royal Infirmary of Edinburgh as the basis of this thesis.

K. G.

INTRODUCTION.

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The first suspicion of its infective nature was seen in its confusion with syphilis in the Middle Ages and exemplified by the writings of Paracelsus in 1530. Despite the work of anatomists like Morgani and Littre, who described the lacunae and glands bearing their names, the confusion remained and was perpetuated by John Hunter. Morgani in 1760 gave the final proof of the discharge coming from the urethra and not the seminal vesicles.

Ricord (1839) has the credit of finally dispelling the confusion with syphilis to which he gave the classical three stages. He failed, however, in thinking of gonorrhoea as a simple urethritis set up by the use of chemicals and "Blenorrhagia" is still the name used in France.

Finally in 1879 Neisser discovered the gonococcus. Scientific study of pathology and bacteriology

since then has added much to our knowledge yet far more remains to be known.

It is only of recent date that gonorrhoea is thought of as more than a specific urethritis. The middle segments, prostate and vesicles, though invisible are parts often involved, and have possibly been too often missed in the past.

Present day treatment has the drawback of redundancy of methods - in itself a reflection on the efficiency of most. The aim of this Thesis is to assess the value of one method of treatment of vesiculitis that has received wide support in certain parts of the world, without anything like the same support from other parts. This method aims at medicating the vesicles by way of the vas. Reference will then be given to methods of treatment of more recent origin in an attempt to put the value of vesicular medication in proper relation to other methods of treatment.

Before describing the clinical cases and discussing the value of vasotomy or the incidence of vesiculitis, it is of value briefly to outline the anatomy of the parts involved and the general aspects of the pathology of gonorrhoea and especially as they affect the seminal vesicles.

ANATOMY.

The evolution of the penis in vertebrates presents progressive types which, because they throw some light on pathology will be briefly recalled.

Reptiles and early mammals have a primitive penis composed of an oblong mass of fibrous tissue marked by a gutter or canal on its surface into which the vasa deferentia empty. It is an exclusively genital organ transmitting semen only, the urine still flowing into the cloaca as in fishes. It lies in the cloaca.

A further step in evolution is seen in the opossum and duckbill. The penis lies entirely outside the cloaca from which it is separated by a perineum. It still has just a gutter, which transmits semen only in the duckbill, or both urine and semen as in opossum. In man this type is seen in the condition known as epispadi^aus. The gutter though called urethra seems to correspond more to the seminal canal than urethra.

The third progressive type shows the development of a new feature. Hitherto the penis was composed only of the corpus cavernosum. The new feature is the acquisition of a corpus spongiosum which is traversed by a new channel, the urethra. The penis now carries two independent canals, an exclusively seminal duct on the upper and an exclusively urinary channel on the lower surface of the corpus cavernosum with no connection between the two.

In the literature examples of this type have been recorded as double urethra. In most cases the upper seminal canal was incomplete. It began near the deep urethra but ended at the corona glandis. Belfield collected twelve such cases who acquired a gonococcal infection. In all the cases the infection was present in the seminal canal, but in only six of them was the urethra involved. This may be taken as an argument in favour of a natural immunity in the urethra as contrasted with seminal tracts.

The final stage in evolution is seen in the obliteration of the seminal canal, - the vasa deferentia, seminal and prostatic glands opening into the posterior urethra. In the human subject we know of the multiple origin of the urethra.

From this sketch, certain structural features of the human urethra may be emphasized.

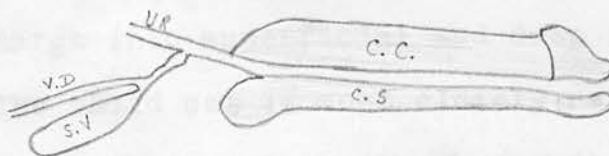
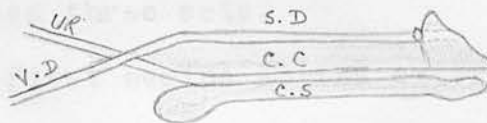
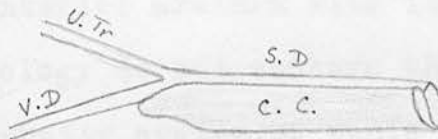
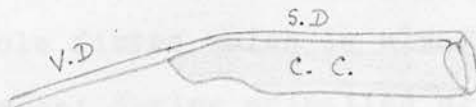
(1) It is an offshoot of the cloacal part of the bladder - caudal part of the anterior subdivision of the cloaca. It resembles it in the many layers of its epithelium.

(2) It becomes a seminal as well as a urinary outlet.

(3) Its wall acquires certain structures that were developed as accessories to the seminal canal, notably prostatic and Cowper's glands as well as the glands of Littre.

Guyon subdivided the urethra on clinical and developmental grounds into anterior and posterior, as contrasted with the anatomical penile, membranous and

PROGRESSIVE TYPES OF PENIS AND SEMINAL TRACTS.



V.D. = Vas deferens
 S.D. = Seminal duct
 C.C. = Corpus cavernosum
 C.S. = Corpus Spongiosum
 Ur. = Urethra
 S.V. = Seminal vesicle.

prostatic. The division is effected by a band of voluntary muscle fibres which is always in a state of contraction except during urination or ejaculation. This muscle, the compressor urethrae or external sphincter, thus completely shuts off the anterior from the posterior urethra.

The anterior urethra with its lacunae and glands and its histology do not concern this present study. Only the lymphatic system of penis and urethra is of value in understanding the modes of spread to the "middle segment" of the seminal tract, the prostate and vesicles. Pawlow-Silwansky by the injection method distinguished three sets.

(1) The first begins at the external fold of the prepuce and proceeds to the inguinal glands.

(2) The second system begins at the preputial fold, sinks deeply to reach the mucosa of the urethra. It then proceeds parallel to the urethral wall in 5-7 strands to the root of the penis. There it spreads out to discharge into superficial and deep inguinal glands.

(3) The third set is most closely related to the urethra. It begins alongside the urethral wall and passes up to freely anastomose with those of the prostate and seminal vesicles.

The value of this study lies in the fact that infection ~~may~~ travel up by them to the vesicles. In the first Venereological Congress in 1924 some cases

of vesiculitis without involvement of the posterior urethra were demonstrated. This may be highly debatable. Schischoff in 1934 reported a case of vesiculitis following a gonococcal infection of a blind para urethral duct without urethritis.

THE SEMINAL TRACTS.

The posterior urethra is very highly sensitive, absorptive and vascular. The floor shows an elevation the verumontanum and crista urethralis. The vesumontanum is about 12-14 m.m. long and composed of erectile tissue which when engorged makes the openings of the ejaculatory ducts pout. On either side is the prostatic sinus into which the minute openings of the prostatic glands discharge.

THE VAS DEFERENS.

The seminal tract starts at the epididymis. It becomes the vas deferens which is about 15"-18" long and 350-450 μ in diameter. Five portions can be clearly distinguished:-

- (1) The sheathless epididymal or testicular portion.
- (2) The scrotal or funicular to the external inguinal ring and which has a fibrous sheath covering.
- (3) The inguinal or trans-abdominal wall within the structures of the spermatic cord.
- (4) The abdomino-pelvic extraperitoneal part hugging the pelvic wall crossing the external iliac vessels and ureter.

(5) The vesicoprostatic or ampullary part, spindle-shaped and with numerous false pouches.

The lumen of the vas is lined with cylindrical epithelium on a basement membrane. With the submucosa it is arranged in longitudinal folds and surrounded by three comparatively well developed layers of smooth muscle capable of powerful peristalsis. Outside this is the adventitia of connective tissue forming a well-marked sheath, except at the testicular part.

The sheath of the vas is of importance in relation to vasotomy. It is loosely attached to the scrotal portion like a tube within a tube. In the inguinal region the sheath may be incomplete and extension of infection from the vesicle may point, causing a funiculitis.

The ampullary part of the vas is a spindle-shaped enlargement. The smooth even lumen of the vas becomes subdivided by plications and folds of its wall into pouches and diverticulae. They vary from 6-10 cms. In structure it is very like the seminal vesicles.

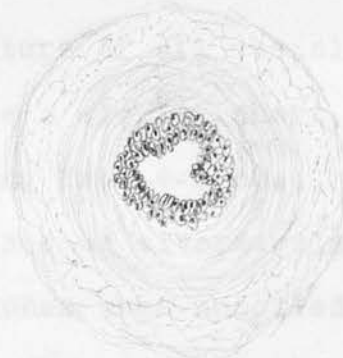
The blood supply of the vas, unlike that of the ureter, is not segmental but continuous by branches from the deferential artery which lies posterior to the vas.

THE SEMINAL VESICLES.

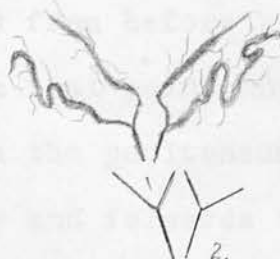
The structure and shape of the vesicles vary with age. Saigrajeff made a study of 120 vesicles



Section of vesicle and ampulla showing
similarity of complex interior.



Transverse Section of vas deferens showing
the thick muscularus coat.



The varying relations of ampulla and seminal
vesicles to form the ejaculatory duct.
(after Ivanizky.)

from bodies of persons of 9 days to 72 years old. In children and boys before puberty the seminal vesicles consist of single tubes with a small quantity of loose cellular tissue between them. With time the structure becomes more complicated. They begin to wind in a zig-zag fashion. The end of the tube can clearly be seen beginning to bend in the form of a hook with the approach of sexual maturity. Thin branches appear at the point of bending. At about 20 years full development is reached.

The vesicles vary somewhat in size and form but this variation has little clinical significance. The characteristic feature of all vesicles is the main canal. This may be a simple, short, straight pouch off the vas, holding from 4-6 ccs., or a short canal with lateral branches or diverticula, or the main canal may be from 8-9 inches when uncoiled but is much convoluted, with irregular diverticula and a capacity of 10-12 ccs.

The relations of the ureter to the vesicles is important. "About the level of the ischial spine, the ureter is crossed from before backwards by the vas deferens and from that point onwards it is not so intimately related to the peritoneum. It then bends slightly medially and forwards to reach the lateral angle of the bladder and comes into relationship with the upper end of the seminal vesicles in front of which

it lies. The vas deferens having crossed the ureter also turns medially and as it does so it lies on a plane posterior to the ureter."

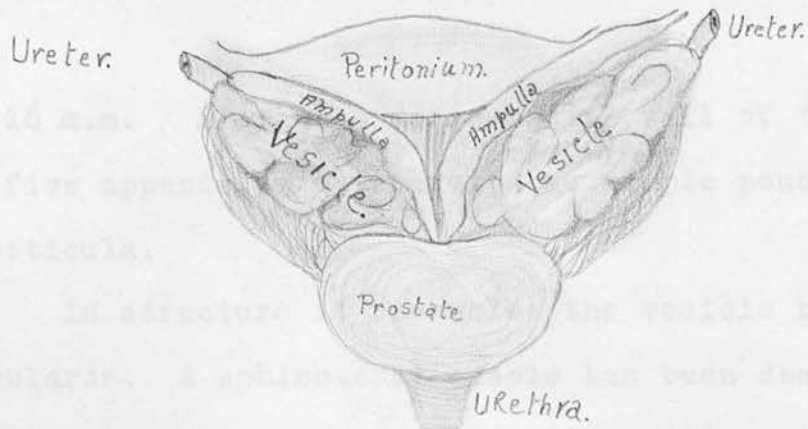
Histology.

The vesicular canal, its branches and diverticula are lined by cylindrical epithelium one or two layers deep, or tall columnar epithelium depending on the functional state of the gland. The epithelium lies on a submucosa without a basement membrane. The submucosa is composed of connective and elastic tissue, surrounding which is a layer of smooth muscle of circular and longitudinal fibres, relatively thin as compared with the muscular wall of the vas and covered by a fine adventitia that binds the convolutions and diverticula together.

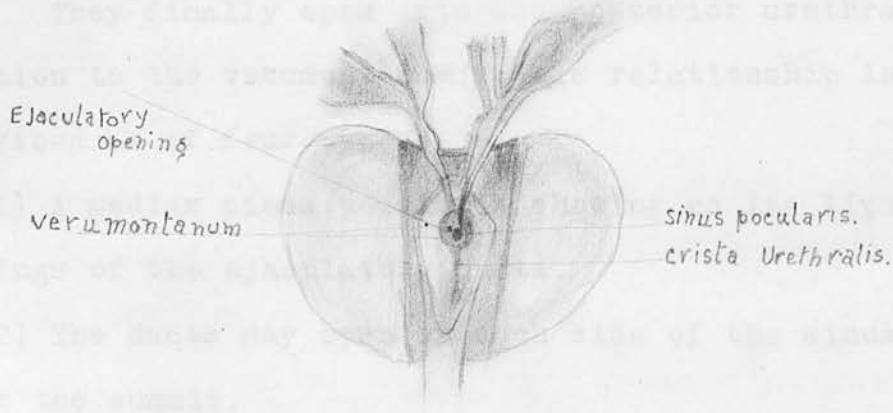
Ejaculatory Duct.

The canal of the vesicle unites with the ampulla of the vas to form the ejaculatory duct. This union most commonly is by direct continuation of the long axis of the seminal vesicle into the duct with the ampulla joining it obliquely. Less commonly the two canals join dichotomously to form the duct. Rarely the duct may be a straight continuation of the ampulla and the vesicle may open off at an angle at the point of union.

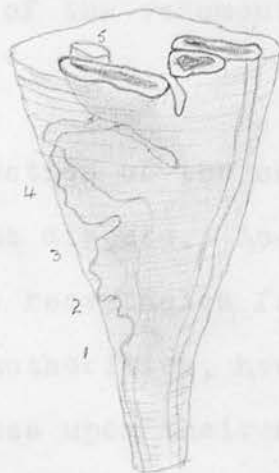
Each duct just after the union of the two canals widens out to form the sinus ejaculatorius, and from this point penetrates the prostate and the vesumontanum X



Basal aspect of bladder, prostate, vesicles and ampulla.



Opening of ejaculatory duct into prostate and posterior urethra. (Rolnick, Urology)



Pouches and diverticula of ejaculatory duct. (Felix)

for 16 m.m. Along the dorso-medial wall of the duct are five appendages interpreted as simple pouches or diverticula.

In structure it resembles the vesicle but has no muscularis. A sphincteral muscle has been described (Belfield) at the point of the opening of ampulla and vesicle into the duct.

They finally open into the posterior urethra in relation to the verumontanum. This relationship is described as of four types:

(1) A median sinus pocularis showing on its lips the openings of the ejaculatory ducts.

(2) The ducts may open on each side of the sinus under the summit.

(3) May open into the floor of the sinus.

(4) There may be no sinus pocularis, the ducts opening on the side of the verumontanum.

FUNCTION.

The chief function of the seminal vesicle has been a matter of some dispute. According to one view they serve mainly as receptacles for spermatozoa before ejaculation. Most authorities, however, are disposed to lay greatest stress upon their secretory function.

Rehfish has shown that if fluids are injected into the testicular end of the vas deferens, they first enter the seminal vesicle and afterwards pass out

through the urethra. He concludes that the seminal vesicles serve the double purpose of secretory glands and reservoirs for semen.

Misuraca states that in dogs and cats which have no seminal vesicles the spermatozoa disappear from the male passages from 5-7 days after castration, whereas in the guinea pigs in which the seminal vesicles are well developed sperms may be found alive as long as 21 days after removal of testes. This is regarded as evidence that the seminal vesicles function as receptacles. It may be mentioned that the seminal vesicles are absent not only in dogs and cats but in many carnivora and marsupials. In animals possessing seminal vesicles and a rutting season they undergo periodic enlargements during the breeding season.

x Lode found that in young animals, in which one testes had been removed, the corresponding vesicle continued to grow and become filled with its own characteristic fluid, thus furnishing a proof of their secretory function. Castration leads, however, to atrophy of the vesicles. This does not occur however after vasectomy.

The character and composition of the vesicular secretion varies greatly in animals. In rodents it clots, forming a "bouchon vaginal." Walker finds in guineapigs and rats an accessory coagulating gland.

In man the vesicular secretion which dilutes the

semen is an alkaline, clear, gelatinous material made up of masses resembling sago grain. There seems no evidence for the suggestion that it has a hormonal influence nor that it activates or nourishes the spermatozoa.

Mode of Emptying:

The mode of emptying of the vesicle is two-fold.

(1) The spasmodic emptying during ejaculation.

(2) A slow regular flow into the urethra and passing back into the bladder. This is proved by the finding of spermatozoa in both urine and urethra apart from ejaculation.

In animals where coloured materials have been injected by way of the vas the same phenomena were observed. After vasotomy both modes of emptying have been observed in the cases studied. This therefore may be taken as the normal mechanisms though physiology has been violated by the trauma and the injections of materials foreign to the body.

PATHOLOGY.

Tissue susceptibility is probably the most important factor in infection by the gonococcus. The mechanism of its ability to invade the tissues of man and its failure to affect the tissues of animals are unknown. The type of epithelium is the generally accepted view but there has been little actual experimental examination of its validity.

Schischoff reported a case where experimental inoculation of 2 cms. into the urethra of gonococci failed to produce a urethritis in man. Biopsy of the urethral mucous membrane 8 cms. from the meatus showed many layers of flat epithelium, not of the cylindrical type and poor glandular development.

Epithelial susceptibility can thus be summarised:

(1) Squamous covered surfaces are immune to gonococcal penetration. They may be irritated by the pus but once that is removed they recover their former condition.

(2) Columnar surfaces as comprising the anterior urethra and its glands, as well as the whole of the seminal tracts, are extremely susceptible. They are slow with their immunity responses and are the surfaces where chronicity of infection is liable to occur.

(3) Transitional cell surfaces fall into two groups:

(a) Those firmly attached to the subjacent structures are quite susceptible to gonococcal penetration but are rapid with their immunity response. To this type belongs the posterior urethra and trigone.

(b) Those loosely attached are immune unless traumatised.

Besides tissue susceptibility two other factors are important.

(A) The physiological factor as centred on the effect of alcohol, sexual excitement, physical exertion

and overzealous treatment as deterrant factors to cure and favouring chronicity. The mechanism by which these factors lower the resistance of the urogenital tract to gonococcal invasion is unknown.

(B) The influence of anatomic configuration on cure which centres on the drainage possibilities of the parts involved. In this respect it is found that -

(1) Good drainage makes for good curative response.

(2) Intermittent drainage makes for chronicity of infection.

(3) No drainage makes for either sterilisation of the parts involved or abscess formation. Cowperitis is and sometimes Littritis are examples of abscess formation, while epididymitis when cured is an example of the other.

It seems that a mucous membrane constantly in contact with gonococcal pus for any period of time undergoes a lytic gonococcal sterilisation of both its contents and its wall. This is seen best in the Fallopian tubes but may have the same result in an infected vesicle or "male pus tube" as called by Belfield.

Posterior and Vesicular Infection.

The actual pathology of gonorrhoea is one of deep penetration as well as surface extension. The posterior urethra becomes involved in 40-80 per cent. of cases. This is by surface extension which is followed by deep penetration.

The prostate and its glands are structures almost always involved to some degree when the infection reaches the posterior urethra.

The involvement of the prostate is described as of four types or grades by Wolbarst.

(1) Catarrhal type which is the mildest. There is a superficial inflammation of the prostatic glands and ducts which remains localised to the region surrounding the vesumontanum. It ends by resolution or becomes

(2) Follicular type where the glands become choked with debris and pus, and may be felt as small shotty elevations.

(3) Parenchymatous type where the inflammatory process involves the whole prostate. It becomes congested inflamed and oedematous and shows marked diffuse cellular infiltration.

(4) Abscess type where the damage is so great that the foci of suppuration coalesce.

How frequently the vesicles are involved is difficult to tell. The incidence on clinical grounds is discussed later.

The avenue of infection is probably by way of the ejaculatory ducts. In the anatomy of the vesicles it was shown that lymphatic spread possibly plays a greater role than has been accorded to it. It may account for the torpid nature of many cases of vesiculitis and the absence of a stormy acute process.

In 1831 Gossei described the first inflamed vesicle removed by operation. He found it enlarged, with thickened walls and its cavity filled by yellowish white material. The excretory duct was also thickened and filled with the same pathological material.

In 1837 Newmann described it thus: "Inner surfaces granulated, pus in the depth of the web like tissue. Abscesses the size of a pea at the openings of the dilated ducts where suppuration appeared of long standing. The excretory ducts were in places blocked by coagulated lymph. Pus has collected in the cavities of the organ. The walls of the seminal vesicle were thicker and harder than normal."

Dillon and Blaisdell from macroscopic study of the vesicles at operation stress two pathological changes extrinsic and intrinsic and classify the cases into four types:

(1) Where neither intrinsic nor extrinsic changes are macroscopically evident, the vesicle had thin atrophic wall distended with secretion. The vesicles were easily stripped from the fascia of Benonvillier and perivesicular tissues. The retention they say is due to stenosis of the ejaculatory duct aided by compression from the engorged prostate. ✓

(2) Where only extrinsic changes were seen ranging from hyperemia and oedema of the perivesicular tissues to dense scar tissue. The intrinsic changes X

being absent and the vesicle may be even distended.

(3) Only intrinsic changes are seen with thickened and indurated vesicles, but with little if any secretory capacity.

(4) Both types of changes are seen with the vesicle nothing more than a relic encased in thick fibrous tissue. The bladder, peritoneum, ureters and vasa drawn more closely together or even bound in one mass.

They have noted that occasionally one vesicle may be severely involved while the other remains comparatively healthy.

Saigrajeff from microscopic study was struck by the relative healthy condition of the vas. He noted that in the lumen of the vesicles the foci of disease were relatively less marked than the surrounding tissues. The epithelial lining was retained in most cases, desquamated here and there and lying like small flakes within the lumen. The single layer of cells may be replaced by many layers. Cellular infiltration most marked in tissues around the vesicle may extend into the sub-epithelial tissue. By special stains he demonstrated the destruction of elastic tissue and its replacement by connective tissue leading to shrinking up and impairment of "mobility."

He believed the areas of greatest destruction were near the blood vessels and lymphatics and that the infiltration was not of a diffuse character.

CLINICAL ASPECTS OF VESICULITIS.

Having briefly outlined the anatomy and pathology necessary for a proper evaluation of clinical conditions and treatment, we can proceed to find out what cases exhibit symptoms or signs of vesiculitis, how far the vesiculitis contributes to the incidence of relapse, and to what extent it is amenable to treatment by means of vasotomy. Relapse here is used to indicate any pathological condition due to the persistence of the gonococcus in some part of the genital tract. The pathological condition being due either to the gonococcus or its toxin and manifesting itself by:

(1) Recurrence of a urethral discharge after an interval of freedom or apparent clinical cure.

(2) Repeated occurrence, or occurrence after an interval of apparent freedom of one or more of the complications of gonorrhoea, whether they are accompanied by urethral discharge or not. Examples of this group being arthritis, epididymitis or iritis.

A study of the case histories of 1000 consecutive cases of urethral discharge reveals the following symptomatology in cases where vesiculitis occurred.

The acute cases, which are those of prostatoseminal vesiculitis may have a severe onset with marked dysuria amounting to acute retention in many

cases. It has been described that the onset may be fulminant with vomiting and abdominal tenderness as to simulate peritonitis, or acute pain may be referred supra pubically and so similar to that of acute appendicitis as to lead to an unnecessary operation (Pugh 29) Supra pubic pain has been complained of in many of the cases but they were all suggestive of cystitis rather than appendicitis. Pain over the inguinal canal or external abdominal ring is usually the first to draw attention to the involvement of the epididymis. The other common features are rectal pain and tenesmus.

Such acute onset was encountered in only a small percentage of patients. The vast majority have only mild symptoms and the later history of the case only shows the occurrence of the vesiculitis. These patients with acute onset have all had a definite prostatic enlargement. In many the enlargement was large enough to make palpation of the vesicles impossible.

Attacks of ureteral colic have not been encountered in the acute cases. It has been described as due to pressure or to extension of inflammation to the lower end of the ureter.

The cases whether starting acutely or insidiously often become chronic. The group of cases of vasotomy illustrate the symptomatology of chronic vesiculitis. It is of importance to note that isolated infection, as may be implied by the terms prostatitis or

vesiculitis, is rare and almost invariably the urethra, vas, epididymis and ejaculatory ducts show some involvement and therefore are better thought of, treated, and even named as the urological syndrome of infection of the genital tract. At one time the prostate, at another the vesicle may dominate the clinical picture, or the epididymis may give the outstanding complaint, but in any case and at all times a consideration of the whole genital tract is required, and the term "Genital tract infection" is more inclusive and correct than either a vesiculitis or a prostatitis alone.

Attempts have been made to classify cases into groups according to some outstanding clinical manifestation. Cunningham gives the following classification:

I. Inflammatory Group.

- (a) Acute with prostatitis and febrile.
- (b) Chronic with a slight or no severe acute stage, obstinate urethral discharge, massage or coitus giving haemospermia or recurrent epididymitis, trigonitis or cystitis.

II. Rheumatic or Metastatic Group.

Compared to teeth and tonsils.

III. Pain Group.

IV. Neurasthenic Group.

Hinman groups the complex symptoms of chronic infection of the genital tract into four subdivisions.

It should be borne in mind that some cases show multiple manifestations or even some aspects of each subdivision. The classification serves not only as a guide in diagnosis, but furnishes some means of tabulation as to results of treatment and therefore is of help in prognosis.

(A) Urological Group.

(i) With predominant urinary symptoms where urethra and probably bladder neck participate. There is frequency, urgency, burning or pain or may be difficulty of micturition or dribbling.

(ii) With predominant seminal signs. The chief complaints being a morning drop, recurrent urethritis, persistent cloudiness and shreds in the urine. These may be accompanied by haemospermia and painful priapism or recurrent attacks of mild epididymitis. A not very common feature is vesicular colic. This is usually brought on by intercourse or alcohol which serves to distinguish it from ureteral colic. The distribution of the pain is the same. Two cases exhibited this symptom and a complete urological examination failed to find any ureteral or renal lesion. This vesicular colic has not been mentioned by many urologists.

(iii) With predominant sexual symptoms. These may complain of loss of desire or power of erection, partial and unsustained erections, premature ejaculations. They may end in impotence and sterility or

sexual neurasthesia or melancholia. In the cases studied this group was lacking.

(B) Focal Infection Group.

This includes all metastatic phenomena where the vesicles act as storehouse of organisms. The most common feature is arthritis - also synovitis, tenos-provitis and fascial sheath in infections. Second important group is the iritis. Bone and even cartilage may be involved. One case of gonococcal chondritis of sternum was found. This cleared up completely with treatment of the vesiculitis as the surgeon to whom the case was referred for opinion advised no surgical measures.

(C) Referred Pain Group.

This includes patients suffering from aches and pains reflected from the segments of the spinal cord which innervate the genital tract. The close association of the nerve supply of the vas and vesicle with prostate and the free anastomosis of their respective plexuses, and higher up with hypogastric and vesical plexuses, explain these referred pains. The nerve fibres all end mainly in the 10th, 11th and 12th thoracic and 1st, 3rd and 4th sacral segments. Reference of pain along the pudental nerves in the back and down the legs and along the perineal branches in the perineum is frequent because of the close relation of the roots of

these nerves to the sacral and lumbar plexuses. This diffuse distribution allows pains caused by pathological conditions in and around vesicles and prostate to be referred to any part of the body below the diaphragm.

Young, Geraghty and Stevens found the following incidence of referred pains.

(1) Low lumbar region or low backache	26%
(2) Supra-pubic	14%
(3) Groin on one or both sides	9%
(4) Testicular	9%
(5) Penis and Urethra	7%
(6) Rectum	7%
(7) Sciatica like, or in hip joint	7%

Referred pain is sometimes very difficult to distinguish from a state of "phobia" with pains in almost every part of the body. They are of frequent occurrence but usually more than one reference was noted in the cases studied.

(D) Abscess Group.

This is rare in gonococcal infections and only one case was found where an abscess required active surgical treatment. The case is one that had a vasotomy done.

In this connection mention may be made of recurrent attacks of unexplained fever as reported by Kidd and others. In tropical countries it may simulate malaria.

On palpation the prostate in chronic cases may feel lumpy, irregularly indurated and adherent or enlarged or it may feel normal. The vesicles and ampulla may be unchanged to palpation, may be inaccessible, or may feel sac-like and fluctuate, or fibrous cord like and adherent. The inter-vasal area may be obliterated by a hard board-like plateau. The general infiltration may even involve the lower end of the ureters or constrict the vesical neck, giving rise to dysectazia or even complete retention.

Diagnosis:-

- (1) A history of a previous or existing urethral discharge.
- (2) Presence of symptoms belonging to one or more of the clinical groups.
- (3) Urinary examination by the three glass test. In chronic cases Wolbarst's five glass test is of value. This is of value in determining the origin of shreds in the urine. It is carried out as follows according to the author:

"In cases of long standing and of doubtful clinical history, in which there is reason to suspect that infection may exist in the upper urinary tracts this test will be found invaluable. The patient comes with a full bladder. The anterior urethra is washed out carefully until the washings come back clear, Glass I; this gives us the débris from the anterior

urethra. Further washing of the anterior urethra gives us a contral glass (Glass II). A fine soft catheter is introduced into the bladder and an ounce of the bladder urine drawn off into glass III; this gives us the bladder urine uncontaminated by contact with any part of the urethra. If this urine is clear we know positively that the bladder and upper urinary tract are normal. This knowledge is extremely valuable in chronic cases. The catheter is withdrawn and the patient voids an ounce of urine into Glass IV; This gives the débris washed from the posterior urethra. The bladder urine known to be clear and the anterior urethra thoroughly cleansed, it is evident that this débris must come from the posterior urethra and from no other part of the tract. The prostate is now massaged and the urine voided into Glass V; this gives us any pus that may have been expressed from the prostate - also uncontaminated, having been passed through a urethral canal that has been thoroughly cleansed. A clear urine in this glass may be accepted as evidence that the prostate is normal. If it is desired to strip the seminal vesicles together or individually, this may be done and the urine voided, after each stripping, into a separate glass (Glasses 6 and 7). Usually it is sufficient for practical purposes to massage the prostate and seminal vesicles at the same time."

(4) Rectal examination and examination of smears

of the discharge which may also be cultured. The presence of clumped pus cells and desquamated epithelial cells are the diagnostic points. The presence of gonococci is immaterial. In the cases examined only one case showed gonococci. Other organisms are present more often. Many of the cases showed complete absence of organisms in the smears. No cultures were taken.

Cultures taken through an endoscope in 100 cases at California University gave the following:

57% Sterile
 23% Staphylococci
 13% Streptococci
 5% Bacillus Coli
 2% Diphtheroids and others

None were positive for gonococci.

Notthaft, however, gives the incidence of positive cultures as follows:

First six months ... 28%;
 6-12 months ... 11%
 12-24 months ... Nil %.

(5) Serology.

A complement fixation test is very valuable in diagnosis. In the cases examined -

71 cases or 42.1% moderate of strong positive. X
 38 " or 22.2% weak positive.
 62 " or 35.7% Negative.

In these cases, however, treatment was in most

cases being carried out and therefore many of the cases with definite lesions were negative. In the acute cases of arthritis the negative results were less than 15%.

Incidence of Vesiculitis.

The general incidence of infected vesicles has been estimated by Pelouze to be the region of 35% of all adult males. This may be a very high figure but the point of importance is that in many cases no history of gonorrhoea was obtained. One may ask therefore what relationship exists between a previous history of gonorrhoea and an infected vesicle. The bacteriology was stated before.

Here only the incidence of extension of a gonorrhoeal urethritis to the vesicles is studied. It has been stated rather vaguely by Wolbarst that over 50% of cases developed vesiculitis which in his opinion demands a vasotomy in the majority of cases. Belfield is of the same opinion.

Here a large group of urethritis have been studied from case histories and personal observation, in order to find out the incidence of vesiculitis in cases of gonorrhoea.

This part also included cases who repeatedly relapsed, and these were studied to see how far the vesicles can be implicated.

Total number of case records 1000, and these were found to fall into the following groups. All presented a urethral discharge of a purulent character when first seen.

(I) 119 cases gave repeatedly negative smears for gonococci. That is 126 of the cases were non-gonococcal. Of these cases, however, 48 had a previous gonorrhoea, i.e. 26%.

(II) Gonococcus positive cases 881.

They were found to form the following sub-groups

(a) 252 cases (and 5 cases from Group I,) i.e. 257 cases or 26% did not have a complete or almost complete records. The majority defaulted; the rest were transferred to other centres. In themselves they form a major problem - that of the defaulter with possibility of further spread of infection. They do not concern this work since their records are very incomplete for any study.

(b) 629 cases or 63% of cases where treatment can be assessed in general. In the study of records, however, there is at times a lack of uniformity of treatment since at times the patients were not seen by the same physician at every attendance. They can, however, be generally grouped into:

(1) Cases with previous gonorrhoea which has been either cured or where patient defaulted or was transferred. These were 89 cases or 12.5%.

Of these only 4 patients have been treated in this centre and discharged cured and where no history of exposure could be obtained.

(2) Cases where condition remained confined to anterior urethra. The following criteria were used in so classifying them. They must obtain throughout the history:

- (a) Clear second glass.
- (b) Absence of dysuria and frequency.
- (c) Negative prostatic and vesicular findings on rectal examination.
- (d) Negative complement fixation.
- (e) The subsequent history.

These cases amounted to 272, or 43.2% of all the positive gonococcal cases.

(3) Cases that did not remain confined to the anterior urethra are 372, or 56.8% of cases. These include all cases where more than anterior urethritis was found when the patients were first seen, as well as those that did not remain so confined after treatment was started. For further study these cases were again subdivided into groups.

(A) Cases where the following conditions only were found:-

- (1) Some slight degree of haziness in 2nd glass.
- (2) Slight dysuria or frequency.

These were 171 cases or 27.2% .

It should be noted here that these cases showed the following negative findings:

- (1) Negative complement fixation.
- (2) " Rectal examination.
- (3) " prostatic smears or the presence of very few pus cells.
- (4) Uncomplicated history.

This group is considered as one posterior urethritis with very slight if any involvement of the prostate. Although it is well recognised that a prostatic seminal vesiculitis may have a very torpid onset and course, yet in view of above findings and also where no treatment was directed against the vesicles, one feels inclined to consider these cases as having had no vesiculitis.

(B) Cases where the onset of pain marked frequency, rectal or perineal or suprapubic pain was present. Rectal examination revealed enlarged tender prostate with or without palpable vesicles. In some the prostate was so large as to be completely unsurmountable by the fingers. These cases of acute prostatitis, or better acute prostatic seminal vesiculitis, were 91 or 14.4%.

(C) 91 cases developed epididymitis which at once implicates the vesicles. It is of note that many of these cases had no acute symptoms until the epididymitis developed. The rectal examination failed to show

any palpable vesicles in many cases despite the indirect evidence of their involvement.

This gives an incidence of 14.4% developing epididymitis. It may be noted that these were all gonococcal, as some of the cases referred for examination with acute epididymitis were found on clinical investigations to be non-gonococcal though acute.

(D) 22 cases or 3.2% developed arthritis, which again is definite evidence of seminal vesiculitis. It may be noted that 2 of these cases gave a negative complement fixation while all the others gave varying degrees of a positive result.

(E) Rarer Complications:-

- (1) Iritis and conjunctivitis (toxic), - 9 cases, 1.2%
- (2) Cowperitis - 3 cases or .5%.
- (3) Para Urethral Abscess needing incision 3, or .5%
- (4) Tysonitis - 4 cases, or .6%.
- (5) Proctitis - 2 cases.
- (6) Skin - Keratoderma - 2 cases (both arthritis).

The frequency of a posterior urethritis as a complication of acute Urethritis varies. It is lowest in special practice and highest in general or clinic practice. The various workers give its incidence as varying between 50-90% in general; and as 30-80% after treatment is instituted. In this group of cases 56.8% cases showed some evidence of posterior infection.

A posterior urethritis almost invariably spreads to the prostate to some extent, though Hinman puts the prostatic involvement as 60-90%. The incidence of vesiculitis cannot be accurately estimated. The degree of prostatic involvement is variable. From the findings stated previously one comes to the conclusion that in this group 201 cases showed that the vesicles may be implicated, while the rest of the cases from findings and subsequent history gave no evidence of vesicular involvement. This makes a 29.6%, or roughly 30% of all gonococcal urethritis may develop vesiculitis. This is in marked contrast to Wolbarst's over 50%. It may be said, however, that every case of posterior urethritis can be "scientifically" considered to spread to the vesicles. The same can be said of every anterior urethritis.

How far the vesicles can be held to blame as a cause of repeated or relapsing gonococcal urethritis is found in the following group cases - from the same series that I have studied. Here 43 cases had one or more relapse, with positive smears after a period of at least 3 weeks apparent cure.

(A) The Two-glass Tests:

(1) When the patients were first seen:

	<u>Hazy.</u>	<u>Slight Haze.</u>	<u>Very slight.</u>	<u>Clear.</u>	<u>Unable.</u>
1st Glass	32	6	4	-	1
2nd Glas	6	10	6	20	1

or by this test roughly :

21 had anterior urethritis alone,

22 " antero posterior urethritis.

(2) At various times of the relapses.

	<u>Hazy.</u>	<u>Slight Haze.</u>	<u>Very slight.</u>	<u>Clear.</u>	<u>Unable.</u>
1st Glass	36	30	12	3	9
2nd Glass	4	15	20	42	9

Three relapses had definite purulent discharge and yet the urine was clear!

(B) Prostatic Examination.

(1) Completely negative .. 25

(2) Slight involvement .. 14

(3) Marked " .. 4

When first seen 18 cases already had some prostatic involvement out of 43 pts.

During the relapses :

(1) Negative finds ... 41

(2) Mild involvement .. 27)

(3) Marked " .. 18) 45

(4) Vesicular " (to palpation)

4 markedly and 12 slightly.

This illustrates one important point that the more chronic gets the case the more likely is the prostate to become involved.

(C) Presence of Other Complications.

(a) Epididymitis - 6 cases
 of which 4 occurred with first relapse.
 and 2 " " second "

(b) Cowperitis with sinus - one case.

(c) Para Urethral abscess - 2 cases.

The cases of Cowperitis recovered without further relapses after opening up the sinus and packing it. Routine treatment of the urethritis together with healing from the bottom allowed a cure to be possible.

(D) Precipitating Causes.

As far as could be ascertained from the patient and recorded it was found that the relapses followed:

- | | |
|---|----|
| (1) Following instrumentation, the passing of bougies or urethroscopes..... | 23 |
| (2) Alcohol (admitted) | 7 |
| (3) Intercourse | 4 |

In this group the question of re-infection could be ruled out. According to Pelouze a patient cured of gonorrhoea acquires some immunity towards it of a short duration. This, however, seems to be a point where no agreement could be reached. None of these patients was married. French workers lay great stress on re-infection from wife or consort who passes unsuspected. This was illustrated in only one case - a record of the history of which is given with vasotomy cases. This patient had repeated relapses and

found later to be due to intercourse with the same consort. It is common, however, to find co-partners both exhibiting gonococci and yet neither showing any symptoms thereof, while a third party would at once develop an acute purulent urethritis if so exposed.

(4) Defaulting during treatment 7 cases.

(5) After provocative polyvalent vaccine 2 cases developed a roaring urethritis.

(6) 43 relapses where no precipitating factor could be ascertained. That is spontaneous.

In this respect one may quote a recent case that illustrates very well the latency of the gonococcus.

Dye in 1934 reported a case of a man aged 70 years who developed acute gonococcal urethritis a few days after prostatectomy. His history showed that he had gonorrhoea 50 years previously.

The point that may be mentioned here is the value of multiple tests as a basis of criteria for cure. Massage of prostate, instrumentation and polyvalent vaccines as provocatives as well as urethroscopic examination were the routine methods used in this group of patients. Many authorities add an alcohol and a coitus test as well. One important factor though not actually a test is time. Three weeks of apparent cure before starting the test and one week for each test of cure is probably the most convenient and efficient routine way in clinic practice.

(E) Number and Duration of the Relapses.

18 cases had one relapse before final cure.

16 " " two " " " "

5 " " three " " " "

4 " " four " " " "

1 " " six " " " "

This shows the majority have one or two relapses only.

In contrast to the initial urethritis a relapse lasts only a short time before the patient again shows an apparent clinical cure. This varied from one day to 20 days, with an average of 8 days as compared to 3-4 weeks in the acute case. The time of onset of these relapses varied from 8 weeks of the initial attack to 9 months with an average of 14 weeks before the first relapse occurred. This shows how a relapse is much more likely to occur in a protracted case than in a case that responds well to treatment.

The following short notes are of cases that remained throughout confined to the anterior urethra.

(1) Single, aged 24, had three relapses, 3 months 5 months and 9 months from onset. He was discharged cured after 13 months. He returned 7 months later with gonococcal urethritis after exposure, though adequate precautions were taken. This was cured in 4 months.

(2) Age 22, single, had two relapses, one after straight bougies 10 weeks from onset and the second after Kallman's dilatation 4 months from onset.

(3) Age 23, single, had one relapse a month after all tests of cure were applied. He showed two follicles that required cauterisation.

(4) Age 24, single, had two relapses, both following instrumentation, after which he defaulted.

(5) Age 42, single, with previous history of gonorrhoea, had three relapses after beer, a $\frac{14}{18}$ straight bougie, and last after urethroscopy. Cautery to follicles was followed by cure in 13 months. The relapses occurred 4, 6 and 8 months from onset.

The remainder of the cases showed at one time or another some definite evidence of posterior involvement. It is, however, significant to note that none of the cases developed arthritis and only two developed epididymitis after treatment was started.

It becomes evident that careful examination of the anterior urethra is essential before any surgical measures directed against the vesicles are to be applied. This is again well illustrated by one of the vasotomy cases.

DESCRIPTION OF CASES.CASE I.

Age 30 years.

State Single.

History:

No previous venereal history.

Exposure 3 weeks previously,
followed after one week by a purulent urethral discharge, and two weeks later - when first seen - patient had:

Purulent Urethral discharge, smears showed abundant gonococci.

Urine hazy in both test glasses. He complained of frequency and depuria.

Acute arthritis of left wrist.

Acute arthritis of left knee.

Prostate and vesicles markedly swollen and tender.

Complement fixation strongly positive.

Patient was admitted to the ward and given hot hip baths, hot local applications to joints and 10 ccs. of Calcium gluconate and no urethral irrigation.

This routine treatment was continued for four days when Vasotomy was advised.

Bilateral vasotomy was done and both vesicles were filled.

Second day after operation the joints felt easier. The urethral discharge was mucopurulent and showed a few gonococci in smears. Both test glass urines were hazy with some slight evidence of the argyrol present. The first two acts of micturition showed argyrol.

X-Rays did not show outline of the vesicles.

Five days after the vasotomy the urine was still hazy in both glasses, with a slight mucopurulent discharge which was negative for gonococci. The patient was discharged from the ward.

Urethral irrigations were started at the outpatient.

One month after the operation there was no discharge, both urines were clear, rectal examination and the prostatic smears contained only a few epithelial cells. Joints were completely normal.

Patient was issued with a travelling card and no further history could be obtained.

Notes:

A case of acute arthritis which responded well to vesicular medication. The evidences of filling were lacking except for colourisation of urine for about two days after the operation.

The best feature of the case is the rather rapid

recovery of the vesiculitis as shown by the rectal examination and the smears. Acute gonococcal arthritis may clear very quickly with routine measures alone. It can be considered as a good result.

CASE II.

Age 36 years.

State Married.

History:

No previous venereal disease.

No extra marital coitus admitted.

Patient was seen with purulent urethral discharge of one week's duration. It showed abundant gonococci in smears.

Both test glass urines were hazy.

Slight frequency and depuria.

Two days later patient acute arthritis of both knees and was admitted to ward.

Usual routine measures were given as well as 10 ccs. of soluseptasine intravenously.

After two weeks the knees improved but the patient developed keratodermia.

Three weeks from onset - i.e. one week later, both feet became swollen and painful.

The urethral discharge was present all the time and both urines were hazy.

After two more weeks of conservative treatment the arthritis seemed very little better and vasotomy was advised - i.e. about five weeks from onset.

Bilateral vasotomy was done and 10 ccs. argyrol were injected into each vesicle.

Second day of operation X-Rays showed no shadows.

Urine did not show argyrol. The clinical condition seemed a little improved but still quite painful.

Ten days after vasotomy the joints were not appreciably better and diathermy and massage were instituted as well as prostatic massage and instillations of acriflavine into the posterior urethra.

X-Rays one month after vasotomy gave the following report -

"Rarefaction of bones adjacent to joint and diminution of joint space. There is some calcification in soft tissues. Appearances are consistent with diagnosis of gonococcal arthritis."

Vaccines as well as other measures continued but improvement was very slow. The peroneal muscles seemed weak and a little atrophied and patient was sent for electrical reactions. The report -

"Peroneal muscles gave weak faradic response from all muscles. Galvanic response brisk k.c.c. > a.c.c. "

Patient continued treatment for about two months and then defaulted.

Notes:

Acute arthritis that failed to respond to routine measures; Vasotomy has not been successful.

This type of resistant case is fortunately not common.

CASE III.

Age 21
State Single.
History:

No previous venereal history.

Exposure was followed after one week by a purulent urethral discharge.

One week later - when first seen - purulent urethral discharge with smears positive for gonococci.

Frequency and dysuria marked.

Urine hazy in both glasses.

Prostate and vesicles large and tender.

Complement fixation weak positive.

Usual measures as well as gonacrine by mouth and intravenously.

Two weeks later patient developed an epididymitis on the right side.

Three months treatment were followed by an apparent cure.

A polyvalent vaccine $\frac{1}{2}$ cc. was given, as is usual in testing for cure. This measure is done after prostatic smears are negative. It is almost the final test before the patient is discharged.

In this case five days after the vaccine was given the patient developed a purulent urethritis with gonococci in the smears.

Examination showed hazy urine in both glasses.

Prostate and vesicles were markedly swollen and tender, with tenesmus, depuria and frequency.

Routine measures were adopted for two weeks and vasotomy advised.

Right-sided vasotomy and a week later left-sided vasotomy were done.

All routine treatment and irrigations were stopped and smears were examined daily.

Three weeks after operation all tests of cure were re-applied. No X-rays were taken.

Patient was discharged cured two months after vasotomy. A small fibrous nodule on right cord was still present on being discharged.

Notes:

This case shows the value of multiple tests of cure. Also the liability of a polyvalent vaccine giving rise to an acute gonorrhoea. It illustrates how at times negative findings do not mean a cure.

Vasotomy in this acute vesiculitis seemed quite successful. No other measures of treatment were adopted. In view of right epididymitis the right side was done first.

CASE IV.

Age 28 years.

State Single.

History:

No previous venereal history.

Exposure followed after one week by urethritis. This was treated by own doctor. After ten days the patient developed epididymitis.

When first seen, two weeks from onset the patient had purulent urethral discharge with abundant gonococci.

Frequency and depuria.

Acute right epididymitis.

Sub-acute left epididymitis.

Urine hazy in both glasses.

Prostate and vesicles enlarged and tender.

Complement fixation positive.

Patient was admitted to ward and given usual measures of treatment and vasotomy advised.

Bilateral vasotomy was performed three days after admission. Both vesicles were filled with argyrol.

On second day of operation X-rays showed evidences of argyrol in vesicles. Patient was feeling quite comfortable.

The urethral discharge continued and the urine somewhat hazy in both glasses and tinged with argyrol.

Four days after the operation urethral irrigations and iodox. to the scrotum were used.

Ten days after vasotomy the discharge was only slight and of mucoid nature. Urine was very slightly hazy in both glasses. Patient was discharged. The smears were negative for gonococci.

This treatment was continued in the out-patients department. Rectal examination showed slight enlargement of prostate but the vesicles were not palpable.

Prostato-vesicular smears were negative.

Five weeks after operation tests of cure were started and gave negative findings. With these findings the patient was transferred to own doctor (London).

Notes:

Acute vesiculitis and epididymitis were treated by vasotomy with a good response. Urethral irrigations and a few prostatic massages were also needed.

Despite X-ray evidence the argyrol very quickly disappeared from the urine and no ejaculation of the drug occurred.

CASE V.

Age: 23 years.

State: Single.

History:

History of gonorrhoea six years previously, treated by irrigations and medicine with apparent cure.

Exposure followed after five days by a slight discharge. One week later when patient was first seen a purulent urethral discharge with many gonococci.

Acute retention.

Acute prostatitis and vesiculitis.

Patient was admitted to ward. Repeated catheterization and usual routine measures.

One week later patient acute epididymitis on the right side, as well as acute arthritis of right knee. Complement fixation became very strong positive.

Usual routine measures were followed after 15 months by an apparent clinical cure. The prostatic vesicular smear still contained a few pus cells. Both vesicles were still thickened.

For two years the patient remained apparently free. After that he acquired a third attack of gonorrhoea.

This was followed by a left epididymitis. Again usual measures as well as the use of autogenous vaccine,

which consisted of -

Staphylococcus albus	200 millions
" aureus	200 "
Streptococci	100 "
Diphtheroids	100 "

per 1 cc.

For eight months the patient attended regularly for treatment. The urine never completely cleared in the two glasses and the patient had a chronic gleet as well.

Prostatic smears contained abundant pus cells. One smear contained a few gonococci, and a vasotomy was advised.

Bilateral vasotomy after 8 months treatment was done. Both vasa seemed permeable and 5% colloidal argenti injected

No X-rays were taken.

Three days after vasotomy the patient had a very severe right epididymitis and funiculitis. One day after it a muco-purulent urethral discharge appeared but was negative for gonococci. Urine hazy in both glasses.

For six weeks the patient had to be kept in hospital. Various other measures of treatment were tried, including a few injections of sulfarsenol.

The patient attended at the out-patient department for over 3 months. After that period tests of

cure were started.

The complement fixation test was still doubtful negative.

Four months after vasotomy a fourth fresh attack of gonorrhoea. This seemed to clear in about 2 months. No further history available.

Notes:

A case of vesiculitis that did not respond to the usual measures before vasotomy was done.

After vasotomy a few more months' routine treatment were required.

The patency of the right vas in view of the epididymitis after the operation is very doubtful.

The result cannot be very accurately assessed. It is certainly not to be considered a good one. Whether the vasotomy was of any value at all cannot be said.

The repeated infections were finally found to be from same consort.

CASE VI.

Age: 45
State: Married.
History:

A history of gonorrhoea four years previously. This was complicated by arthritis. Patient was treated by usual measures and made an apparent cure.

Patient remained free of symptoms for four years. He developed "rheumatism" which was treated by own doctor.

Six months after the attack of rheumatism with no apparent cause - no exposure nor recent coitus, - patient developed a muco-purulent urethral discharge. Smears were negative for gonococci but contained abundant gram positive cocci.

Examination showed the presence of a lightly enlarged prostate, thickened vesicles and -

(a) Arthritis of left knee with effusion, atrophy of quadriceps extensor but no limitation of movement.

(b) Slight peri-articular thickening of left elbow; no limitation of movement.

(c) Pain in the lower back.

The complement fixation test was moderately strong positive.

Treatment by irrigations and diathermy was instituted.

X-ray report was as follows -

- (1) Lumbar spine showed slight arthritic changes between 1st and 2nd lumbar vertebrae.
- (2) No visible arthritic changes in left knee.
- (3) Right wrist shows destruction of articular surface of ulna. The condition appears to be developmental rather than pathological.

Patient was admitted to ward and a bilateral vasotomy was performed. Both vesicles injected.

X-rays showed no evidence of argyrol in vesicles.

On second day of operation the patient felt all joints to be a little better.

The urinary symptoms required irrigations. Massage of prostate and vesicles and other measures for 2 months gave a gradual improvement.

Prostatic smears became free of pus cells. Complement fixation doubtful negative.

Six months later patient came back with swelling of left knee. Complement fixation strongly positive. He is still under treatment.

Notes:

A case of recurrent arthritis. No appreciable response after vasotomy: Recurrence six months after the operation.



CASE VII.

Age: 25 years.

State: Single.

History:

First attack of gonorrhoea 4 years previously; this was treated by usual routine measures, but the patient did not complete the tests of cure.

Second attack two years later but repeated examination revealed no gonococci.

Prostatic examination - negative

Complement fixation - negative.

Routine measures were adopted. A somewhat gleetty discharge tended to become chronic. After 8 months' treatment an apparent cure was obtained.

Four months later patient developed a subacute arthritis of left knee and a subacute epididymitis. The prostate was very slightly larger, but the complement fixation was still negative.

Six months treatment did not give a cure; the complement fixation test being now weak and positive. Patient was advised to have a vasotomy done and have his teeth attended to.

Bilateral vasotomy was done one month later.

Two days after operation the patient developed enormous swelling of scrotum; the cord was very much

thickened. The state of epididymis could not be ascertained, but both it and testes seemed markedly swollen. Magnesium sulphate soaks gradually gave some relief. The wound seemed to heal by first intention.

The patient was discharged after ten days with testes still swollen. He attended the out-patient department.

Four months after the operation the cord as still thickened, the testicle somewhat larger than normal. The arthritis, however, had disappeared and tests of cure were all negative including the complement fixation.

Notes:

The value of vasotomy here is difficult to assess. Even had the result been an undoubted success, the scrotal and testicular complication would nullify it.

One point is of interest. Is it the removal of the teeth or the vasotomy that helped the arthritis?

CASE VIII.

Age: 31 years.

State: Married.

History:

Gonorrhoea five years with apparent cure.

Three years later without E.M.C. nor M.C. Since last attack, the patient developed acute iritis of right eye.

Examination revealed a slightly enlarged prostate, palpable and tender vesicle on the left side.

Prostatic smears showed pus cells and abundant gram + organisms.

Complement fixation - weak positive.

After eight months of treatment local, vaccines and other usual measures, the patient was discharged cured.

18 months later a second attack of acute iritis. This was treated by usual measures for four months and then patient advised to have vasotomy.

Bilateral vasotomy was done two months later. There was some X-ray evidence of argyrol.

Four days after operation a black nocturnal emission occurred.

Patient was discharged from ward 8 days after the operation.

He has reported regularly for observation.

Notes:

Evidence of filling of vesicle is quite distinct. The operation had no complications and the patient has had no recurrence of his iritis for 9 months. This is a very short period but one point is of interest. The previous attacks always occurred in February and he has had none this year.

CASE IX.

Age: 32.
State: Single.
History:

Patient a gonococcal urethritis, and cured, and also a non-gonococcal urethritis and again cured.

Last attack one year previously and seemed only an anterior urethritis when patient was first seen.

It did not respond well as some follicles which caused a relapse required treatment. Again he relapsed but this time he developed acute vesiculitis followed after four days by epididymitis on the right side.

Routine measures were continued but urethral smears remained persistently positive, and both vesicles palpable. G.C.F.I. +++

Vasotomy was done on the right side only.

It did not affect the infection in any degree as the patient still had a discharge with gonococci.

One month after vasotomy three follicles were cauterised. After this the patient made a good recovery and was discharged cured.

CASE X.

History: (1) 1932. 1st attack of gonorrhoea.

This was complicated by occurrence of

- (a) Two peri urethral abscesses,
- (b) Prostatic abscess that had to be opened "done per rectum."
- (c) Second prostatic abscess that opened spontaneously into urethra.
- (d) Epididymitis with abscess formation.

Despite all these, routine measures of irrigations, vaccines, etc. effected an apparent cure.

(2) 1934. After a period of freedom from urinary symptoms patient developed a left epididymitis apparently spontaneously.

Examination revealed a slightly enlarged prostate and vesicles, not tender; but a slight gleet was also noted. A diagnosis of chronic prostatitis and vesiculitis was made.

A cystoscopic examination was attempted to ascertain the condition of the bladder and especially trigonal area and possibly the posterior urethra.

"Bladder and upper urinary tract normal. Congestion etc. of posterior urethra and prostate."

This precipitated an attack of "colic."

Following this and for a period of about 3 years the patient suffered from repeated attacks of the same "colic." It had a sudden onset, usually at the end of the day; severe colicky pains down the inguinal canal but not reaching to testes nor spreading to inner sides of thighs. It was accompanied by sweating, pallor, but unaccompanied by vomiting. It was relieved by morphia or atropine or both. This led to the gradual development of a severe degree of craving for morphia.

(3) In March 1937 the patient after one of his attacks developed a purulent Ur. discharge with G.C.+ No history of exposure, and examination of his wife showed to be apparently free.

No ureteral nor renal cause could be found to account for these attacks of colic, which though greatly resembling ureteral colic are considered to be in the nature of vesicular colic in view of the history and consequent progress of treatment.

Bilateral vasotomy was performed and 20% argyrol instilled into both vesicles.

X-rays showed evidence of argyrol. Argyrol appeared in urine continuously for 3 days.

Gradual recovery with but a slight infiltration of right cord.

Attacks of colic have stopped and urethritis cleared up except for occasional gleet negative for G.C.

Morphia habit responded well.

CASE XI.

Age: 50 years.

(1) History of gonorrhoea 10 years previously treated by usual measures. Ever since, however, patient became subject to repeated attacks of urinary infection with occasional discharge from urethra.

Repeated examinations revealed only a bacillus Coli infection and no gonococci. These responded to usual measures.

(2) One year ago patient developed a subacute left epididymitis and a B.Coli urinary infection.

Prostate was slightly enlarged and the prostatico-vesicular smears contained a number of pus cells but no gonococci.

Neither the Epididymis nor the infection showed any material improvement with usual measures of treatment.

A left vasotomy was done and 20% argyrol instilled.

The B.C. infection became less severe; the Epididymis remained thickened but not actively inflamed. General health much improved.

No X-rays were taken. Argyrol appeared in urine for one day only.

CASE XII.

Married: alcohol

(1) 1922 - G.C. urethritis treated by usual method with apparent cure and freedom for a period of five years.

(2) 1927 - G.C + urethritis but re-infection denied - again with apparent recovery; but followed by repeated non G.C. urethritis for a period of two years.

(3) 1934 - Patient commenced to have attacks of colic on one or other side. These were treated as "stricture of ureter" for about a year without evident relief.

(4) 1935 - Patient Epididymitis and G.C. and urethritis as well as attacks of "colic." These were experienced usually during the night but before retiring. Pain of a colicky nature along inguinal canal, accompanied by haematuria, frequency and urgency of micturition. A rather unusual feature of these attacks is a persistent erection that accompanies them, painful making the patient bend over and grasp the penis in an effort to relieve the pain. The nature of these is unrelated to any emotional or sexual excitement.

Occasionally actual retention of urine accompanies these attacks and haemospermia.

After preliminary routine measures a vasotomy was decided upon. The nature of these attacks being now taken as of vesicular origin.

Bilateral vasotomy was performed and 20% argyrol instilled into both vesicles. X-rays showed evidences of argyrol which continued to leak daily into urine.

After five days patient was discharged.

A week after operation a nocturnal emission of almost pure argyrol took place.

For 10 months the patient remained free of all symptoms and seemed quite cured.

(5) G.C. + urethritis was now traced to infection from his wife. It responded well to ordinary measures.

For two years patient has remained free and can be considered as completely cured.

CASE XIII.

(1) 1926. Acute G.C. Urethritis treated by routine measures.

(2) 1931. W.R. and G.C. urethritis - treated for both.

For four years patient developed a recurrence of the discharge but negative for G.C.; pain and frequency of micturition after every coitus. This on top of a gleet discharge that was present though not persistently.

The prostate was enlarged. The smears contained pus cells but not organisms.

After routine treatment the patient developed same train of events after consuming a large amount of alcohol but without coitus.

The prostato-vesicular smears contained staphylococci and streptococci but no G.C. A chronic vesiculitis was diagnosed and vasotomy advised. Clinical and serological tests were negative for syphilis.

Bilateral vasotomy showed good filling of right vesicle on X-rays.

An uneventful history after operation with no recurrence of discharge though patient is a sea-faring man addicted to both alcohol and sexual excess.

Indications.

In 1905 Belfield in J.A.M.A., under the title of "Pus tubes in the Male and their surgical treatment" wrote:-

"In a few cases I have practised a therapeutic measure which, according to my present information, is novel, namely, injections into the vas deferens and seminal vesicles through a needle introduced into the vas just above the epididymis. As the dilated upper extremity of the vas, the ampulla, bears about the same relation to the vesicle that the auricle does to the ventricle of the heart, a liquid injected into the vas easily reaches the vesicle; this can be clearly demonstrated by injecting prussian blue in water into the vas of the fresh subject.

The therapeutic value of such injection is not yet accurately determined, at present it can be merely affirmed that this is a practicable way and as yet the only way for directly medicating the male genital tube including the vesicle, which is so commonly and so persistently infected by various pus bacteria and by the gonococcus."

Later in 1906 he published a list of indications.

"Irrigation and drainage of the seminal duct and vesicles I have found to be invaluable in the treatment of the following conditions:

(1) Chronic gonorrhoea of the seminal vesicles with or without a glee discharge.

(2) Chronic pus infections of the seminal canal in middle aged and elderly, usually mistaken for enlarged prostate.

(3) Recurrent epididymitis which results from repeated invasion of the epididymis by an infection persistent in the seminal vesicles.

(4) Acute gonococcal seminal vesiculitis where incision into the vesicle from the rectum with galvano-cautery is sometimes desirable for the immediate relief of severe symptoms.

Finally in 1920 he advocated it for acute cases and concludes thus:

"The traditional and still prevalent conception of acute gonorrhoea as specific urethritis presents only a half truth, for in the majority of the cases the disease becomes urethro vesiculitis within the first month. The rôle of the vesicles is proved not merely by the detection of their pathologic condition by the trained finger but strikingly by the pronounced mitigation of symptoms which follows immediately on filling them with a proper solution by way of the vas. A patient had for 6 days urinated painfully every $\frac{1}{2}$ -2 hours day and night. Immediately after his vesicles were filled with 5% collargol solution, the pain disappeared and the urinary intervals promptly increased.

to 4-5-7 hours. The prompt arrest of the vesicular infection in the acute stage averts chronic seminal vesiculitis with its manifold evils."

In this country Frank Kidd reported the results of 25 cases done over a period of 15 years. His conclusions are as follows in 1923:-

"A seminal vesicle infected with gonococci or bacillus coli or other organism can remain blocked and full of the infecting agent for many years. The victim may suffer from relapsing fever and rigors, from relapsing urethral discharge, from arthritis or iritis, from impotence or sterility and from neurasthenia. In some cases the neurasthenia is so severe as to almost amount to psychosis. All these troubles except the iritis can be cured by vasostomy.

What then are the indications for this operation?

1. I think that it is clearly established that it should be employed in all cases of chronic relapsing gonorrhoea (or B.Coli vesiculitis) in which there is evidence of thickened closed vesicle or vesicles and in which 4-6 months consecutive and careful treatment by massage, urethroscopy and so forth has failed to produce a cure.

2. It should also be used for cases of chronic arthritis with chronic relapsing epididymitis that do not yield to such treatment.

3. Cases of relapsing attacks of fever, rigors and pyuria and epididymitis caused by B.Coli and others.

4. Finally I believe it should be used for many cases of severe arthritis in the early stages."

Since its introduction the views expressed have been so at variance and the indications for it as presented by different adherents of the operation are so wide in their scope that it seems wise at this point to give them mention in order that they may be correlated with the pathologic changes and the probable effect of the operation upon such changes. Generally speaking they can be included under non-tuberculous infections of the seminal vesicles, proved refractory to non-surgical treatment and causing

- (1) Chronic urethral discharge.
- (2) Symptoms of cystitis or prostatism in men of the prostatic age.
- (3) Referred pain in the supra-pubic, perineal and inguinal regions.
- (4) Impairment of erection.
- (5) Premature ejaculation.
- (6) Necrostermia with consequent sterility.
- (7) Occlusion of the ejaculatory ducts.
- (8) Urinary infection with various bacteria.
- (9) Remote results of focal infection such as arthritis or phlebitis from other organisms as well as the gonococcus.
- (10) Prevention of epididymitis in acute gonorrhoea involving the vesicles.
- (11) Prevention of recurrent epididymitis.
- (12) Prevention of the vesiculitis and epididymitis following prostatectomy.

The group of cases whose case records have been described and whose vasotomy was done had the following indications:

(A) Acute Group.

Five cases of acute gonorrhoea, 1 week to 6 months duration with positive smears, all had evidences of vesiculitis and exhibited the following clinical indications:-

(a) Acute Arthritis.

(b) Acute Epididymitis.

(c) Repeated urethral discharge.

(B) Chronic Group.

Light cases of 6 months to 4 years duration with evidences of vesiculitis, and exhibiting the following clinical indications:-

(i) Urinary: infected urine and tendency to recurrent retention of urine.

(ii) Seminal: Recurrent discharge, vesicular colic and priapism and haemospermia.

(iii) Metastatic with

(a) Arthritis.

(b) Iritis.

RATIONALE OF VASOTOMY

The proper employment of vasotomy must depend primarily upon a thorough knowledge of the pathological changes to be dealt with and to what extent they are amenable to the procedure. It is quite essential therefore that the limitations or contra-indications be understood.

The rationale of vesicular medication is not easy to understand. It has been pointed out in pathology that gonorrhoea means not just a surface invasion but deep penetration. Pelouze puts it as "No penetration no gonorrhoea". If such holds good for the urethra, it is almost certain to hold good for the seminal vesicle. Secondly the mode of infection of the seminal vesicles is not entirely a matter of extension though this may be the chief method. Microscopic study as noted in the pathology gives evidence of lymphatic spread as well.

From this it becomes difficult to understand the rationale of a line of treatment which seeks to cure the infection in the vas or vesicle when the accompanying infection in the prostate, which must always be present, is either untreated, or treated by methods which produce much slower results than is claimed for vasotomy. How can re-infection be prevented and especially so in cases treated early? Also it

makes one wonder how it is possible for a single infection of an organic silver compound to bring about sterilization of the infected seminal vesicle when under the best conditions in the urethra it fails to accomplish such results.

It is argued by Belfield that the vesicles are better adapted for a single medication. He says "that a given infection is far more amenable to treatment in the vesicle than in the urethra for two reasons. First because the unstratified vesicular mucosa is devoid of lacunae, follicles and glands such as crowd the urethra. Second because the vesicle like other sacs enclosed in unstriped muscle, e.g. the stomach, automatically churns its contents. Since the colour of the emitted semen proves the presence of the collargol in the vesicles for weeks after they have been filled with it we can understand that a single filling followed by weeks of automatic mixing with the infecting agents unprotected by the follicles may end acute infection in the vesicle though producing far less effect in the urethra."

It must be pointed out that vesicles though devoid of follicles have an interior much more complicated than the urethra. Also the silver preparation does not last for weeks in the vesicles, even if it is admitted that it gets there.

This is supported by Kidd who nevertheless

advocates vasotomy. He says "that the colloid silver is often passed at the next few acts of micturition. Sometimes it is retained for days and is then usually passed in a nocturnal emission." He continues "Colloid silver appears to have a softening action on inspissated secretion and plugs present in chronic vesiculitis. When the duct is blocked a fresh opening is made into the deep urethra through which the softened contents are discharged." It is highly improbable for the ejaculatory duct to be so completely blocked and yet the vesicular duct remains patent, and also it is doubtful if any preparation can make a new ejaculatory duct.

An unquestioned surgical principle is that where infection exists in an anatomical sac, the first indication is drainage of this sac. Whether this be established through the anatomical channels or obtained by opening the sac depends on the pathology of the part involved. The treatment of an infected sac by bactericidal agents without drainage avails nothing and is essentially poor surgery. If such principles be applied to the vesicles it becomes evident that blocking of the ejaculatory ducts and conversion of the vesicle into what Belfield calls the "male pus tube", to be treated by medication and its "churning effect", is not based on very sound principles.

It is equally unquestioned that if the wall of

the sac is so involved that drainage will not suffice then the treatment of choice is the removal of the sac if the results obtained can be judged good enough to justify the operation and its risks. In the case of the vesicles they do not, and the condition is not of danger to life.

It must therefore be concluded that vasotomy, to be of any value, and it is of value in some cases, must facilitate or establish drainage. Horseley in 1920 has shown that where a foreign substance was introduced into a cavity lined with epithelium, two forces were set at work for its expulsion and protective drainage:-

- (a) Spasmodic efforts on the part of the surrounding musculature.
- (b) A reversal of the lymph stream.

The one point that emerges from this study is that for vasotomy to be of value the vesicular wall must be in such a condition as to still be capable of spasmodic contractions. Any marked degree of fibrosis of its wall or perivesicular fibrosis would therefore greatly reduce its value. It is, however, upon these two physiological factors that what benefit may be derived from vasotomy depends.

Value of Rectal Examination:

It has been shown that the pathological changes in seminal vesiculitis vary a great deal. Dillon and

Blaisdell have described four types according to the degree of change in the wall of the vesicles and their surrounding tissues. Rectal examination, though admittedly not always giving a true indication of these changes, yet in the majority of cases yields information that can be used as a guide to treatment.

It is important to correlate the pathological changes assumed to be present as felt per rectum with whatever benefit one might expect from medicating the vesicles.

In types 3 and 4 as described by Dillon, where the vesicular wall becomes enormously thickened and where the cavity of the vesicle is greatly reduced and where the perivesicular fibrosis gives the feeling of a board-like platena or thickened indurated cords, then one can hardly expect any benefit from vasotomy. Such cases are usually those with symptoms of irritable bladder or prostatism or neuritic pains of varying distribution. This same pathological picture may be associated with other conditions that are considered by many as definite indications for vasotomy, such as chronic arthritis or recurrent epididymitis. If such is the case then vasotomy will probably fail to give any benefit.

In the other types of pathological changes in vesiculitis, the vesicle is distended and its wall

instead of being thickened is actually thinned out, as are the mucosal septa of its pouches and diverticulae. On rectal examination many vesicles feel cystic without marked thickening indicating no undue fibrosis. It may not "strip" easily. It may be noticed that the rheumatic pains feel easier after a nocturnal emission. To this may be added the type with recurrent urethritis, its occurrence being noted to follow intercourse or nocturnal emission. The cystic change is due to some obstruction of the ejaculatory ducts from inflammation and from pressure in acute cases but may remain as such in chronic ones. It is presumably this type that on pathological grounds may derive benefit from vasotomy.

Evidences of Vesicular Filling.

It has been assumed that since the fluid injected via the vas passes readily through, then it must fill the vesicle before passing into the urethra. There is general agreement on that point based on experiments on animals and operations on the cadaver. In both cases the tissues have not been subjected to the action of the gonococcus. In pathological conditions of structures like the ejaculatory and vesicular ducts, the latter specially, their patency is open to very grave doubts.

In vasotomy cases the evidences of vesicular filling are -

(1) Radiographic, where both ampulla and vesicles are outlined and filled with the opaque solution. Kidd says "That it fills the vesicles as well as the ampulla can be proved by radiography. The vas has a powerful sphincter so that sperm or colloid silver coming down the vas regurgitates into the vesicle." Neither he nor other vasotomy advocates give any mention of how often this evidence is obtained.

In the group of cases studied, radiographic evidence was obtained bilaterally in three cases, unilaterally in one and absent in the rest. It must be mentioned, however, that many of the cases had their X-Ray examination on the day following the operation.

(2) Indirect evidence of filling as shown by the urine containing the drug for some days following the operation, or what is more convincing a nocturnal emission of the drug used; unmistakable by its black colour.

Again 3 cases only had a nocturnal emission; 4 continued to pass the drug in urine for one to five days. The rest of the patients were clear of the drug a day after the operation, it being passed in the first few acts of micturition.

It seems evident from these cases, at any rate, that the drug may find it impossible to get into the

vesicle because of the canal being blocked, may find it easier to pass through the ejaculatory duct and get into the bladder as soon as it is injected, and only occasionally does it fill the vesicle. It may be of value in itself by washing out the ejaculatory duct and hence promote drainage from the vesicles in the post-operative period.

After being in use at the clinic, this was found not only at the time of the operation but also on subsequent days. It was his practice after epididymectomy to treat the seminal vesicles in that way.

In gonorrheal infections, McCall in 1909 was the first to advocate the use of injecting collargol. Since that time have practiced the operation and added some modifications to the technique and other substances in place of the collargol.

Extracapsular

In his original technique, and possibly before, it was found that the practice of doing more than one injection, McCall introduced a lateral canal into the testis and kept it open. Because this made some temporary opening or canal in the testis he called it "Vasostomy."

In 1914 Jackson described a technique where an opening was made into the testis by a needle and syringe. For this modification he coined the name

THE OPERATION.

History.

The injection of chemicals into the seminal vesicles dates back to the early work on the treatment of tuberculosis of the vesicles. In 1901 Young of Baltimore proposed injecting carbolic acid into the vas after bringing it out at the groin. This was done not only at the time of the operation but also on subsequent days. It was his practice after epididymectomy to treat the seminal vesicles in that way.

In gonococcal infections, Belfield in 1905 was the first to advocate its use by injecting collargol. Since then many have practised the operation and added some modifications to the technique or used other substances in place of the collargol.

Nomenclature.

In his original technique, and possibly following what was then the practice of doing more than one injection, Belfield introduced a silver canaliculus into the vas and kept it there. Because this made some temporary opening or mouth in the vas he called it "Vasostomy."

In 1914 Thomas described a technique where no opening was made into the vas except by a needle and syringe. For this modification he claimed various

advantages. He gave this operation of his the name of "Vasopuncture."

Belfield , after experimenting with other silver preparations, found that one injection was all that was needed. In 1920 he modified his operation of leaving a canaliculus in the vas by making a puncture with a bistoury, introducing the needle and doing one injection. He called this "Vaspuncture."

The name "Vasotomy", which is the most commonly used term, has probably been given to this operation by Thomas to contrast it with his "Vasopuncture". Belfield claims ignorance of its "parentage". Since the opening made into the vas is done by a knife, vasotomy seems a better term than any of the other names that have been given to this minor operation.

Preparation:

All the patients who had vasotomy done were inpatients, either on account of their clinical condition or preparatory to the operation.

Beyond the simple measures of a mild laxative the night before and a light breakfast no special preparation was done.

Some American surgeons on the morning of the operation do a bladder and urethral lavage. This is followed by prostatic and vesicular massage to empty them out, and a second wash out given.

It was considered contra-indicated in the acute cases to do any massage. The chronic cases have had that routine treatment for some time before the operation and did not make a part of it.

The supra pubic and scrotal skin was shaved and prepared by soap and water and sterile dressing. At the operation alcohol followed one paint of iodine were used.

Anaesthesia:-

Evipan sodium 1 gram dissolved in 10 ccs. distilled water was used. In most cases it had to be supplemented by a local anaesthetic of 3% planocaine. Both together gave very good anaesthesia.

The operation, however, has been done by many surgeons under local anaesthesia and quite successfully. In view, however, of the importance of rest after the operation, and the natural apprehension of most patients, a general anaesthetic was preferred. After the operation the patients were sent back to the ward. Some surgeons make the procedure a consulting room one, sending their patients home after the operation. Kidd used open ether and no local anaesthetic.

Technique:

The spermatic cord is grasped between finger and thumb in the part between the external inguinal ring and upper part of epididymitis. By manipulation the vas deferens can be gradually freed from the

structures of the cord and is brought, with as little as possible of these structures, to just beneath the skin.

A pair of Braun towel clips or forceps grasp the skin and the vas, and another pair is put in the same way about $\frac{1}{2}$ - 1" from the first. Gentle traction of the two instruments renders tense the scrotum overlying the vas.

An incision $\frac{1}{2}$ " long exposes the vas. The vas is then seized with a pair of tenaculum forceps and with a few strokes of the knife freed from its loose outer coating of areolar tissue. The handle of the scalpel or a thin flat guide can now be pushed underneath it. The vas is now stripped quite bare of its sheath until the muscular coat is seen, care being taken to avoid its artery on the posterior aspect and also to avoid over-dissection and consequent traumatization.

With the vas stretched over the handle of the guide or on a piece of boiled tape, a tiny opening is made in its longitudinal axis, using a sharp pointed tenotomy knife. This requires a little pressure and is best done by the point of the instrument, stabbing fashion.

A silver canaliculus with a blunt point and of 19 - 23 gauge is now gently passed, with visual guidance, along the lumen of the vas. This should not

require any force at all and once the canaliculus is in the proper place it slides in quite freely. It is important to use a size that will go in easily since a larger size may strip off bits of the mucosa and may thus traumatize it and lead later to stenosis.

Cover over the small wound with sterile gauze, leaving only the vas and the handle of the scalpel out. This is done to prevent any of the solutions used from falling on the tissues of the spermatic cord.

A syringe containing a few ccs. of saline is now attached to the canaliculus and the piston gently and carefully pressed home. If the needle has been correctly introduced and the vas is patent, the saline will flow in without any undue pressure, giving exactly the same feeling as an intravenous injection.

Detach the syringe, keeping the cannula firmly in position. A 10% solution of argyrol is used to fill the syringe which is now reapplied to the cannula and with the greatest care injected into the vas. Usually from 10 - 20 ccs. are used but if more can be injected with ease then 30 ccs. is the maximum amount to be used.

Again remove the syringe and fill with saline. Two ccs. are injected into the vas to prevent regurgitation when the cannula is removed.

Lastly the cannula is withdrawn. A fine catgut suture unites the divided sheath and areolar tissue over the site of the puncture. The vas is then

replaced into its proper position and skin incision sutured and covered with gauze.

The same procedure is done on the opposite side.

A dressing and a T bandage supporting the scrotum are applied and the patient taken back to bed.

Modifications.

(a) Belfield.

In his first operation the above technique was used except that at the end of the operation he tried slinging up the vas with a strip of rubber sheeting. He dropped the vas back into the wound and fished it up again every other day for re-injecting. The use of the rubber was thought to be the cause of sloughing of the vas in some of his cases and was abandoned.

His second method for slinging up the vas was as follows:- A fine hypodermic needle with a strand of silkworm gut threaded through it was carried into the lumen of the vas and out through the skin $\frac{1}{2}$ " above. The needle was withdrawn leaving the thread. Its projecting ends were knotted but not tied together. This thread was to act as a drain out of the vas and a guide for the blunt needle into the vas for subsequent injections. It was removed on the 5th day.

Lastly he used one injection into the vas and his technique was the one described except for one difference.

As a means of testing the potency of the vas

and making certain of being in the lumen he used the following procedure:

"After passing the needle inject 10 ccs. of 1 in 25,000 methylene blue solution. This should presently cause a desire to urinate. The urine passed should show the dye. If the colour fails to appear in the urine the procedure is faulty and must be corrected or abandoned. The other side is injected with fuchsin for contrast."

It may be commented here that Belfield insists that solutions injected via the vas must fill the seminal vesicles before passing on to the urethra. If such is true then the methylene blue must fill the vesicle. How then is the silver compound to replace it? It seems that even in Belfield's cases most of the medicament passes on at once to the urethra.

(b) Kidd Vasostomy.

The same steps are done till the vesicles are filled with colloidal silver. A wire was then inserted down the canula to keep it from getting blocked. A fine silkworm gut suture was inserted mattress-wise right through both sides of the skin and fascial incision beneath the vas. This was returned and passed again $\frac{1}{2}$ " below through both layers of skin and fascia likewise beneath the vas.

This suture was tied and thereby leaving the vas slung up on a bed of connective tissue securely

anchored at the level of the skin. Each of the two rings provided on the canula were fixed by means of a fine silkworm suture to the skin on each side. The wound was sprayed with malachite green ethyl chloride to prevent sepsis, a dressing put on and a T bandage. Two more injections were given by removing the wire and attaching a syringe.

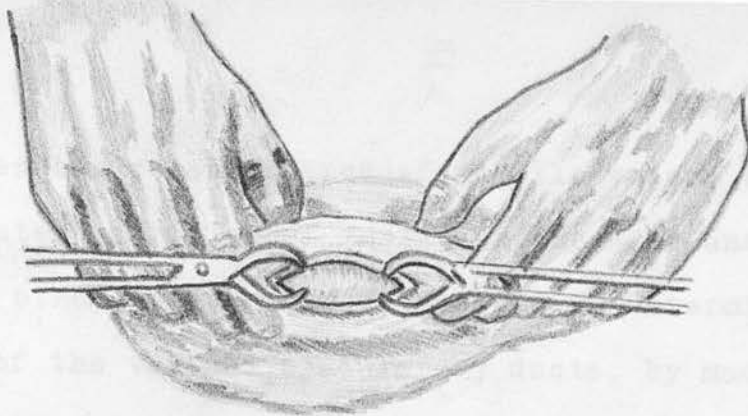
On the 5th day the silkworm gut slinging stitch was taken out, and with the fingers the wound was manipulated so as to loosen adhesions round the vas and make it drop back into its proper position deep in the scrotum. Unless this was done the vas may remain adherent to the skin wound and the opening may persist as a spermatic fistula.

He claimed that 2 or 3 irrigations were essential and that his technique avoided sloughing of the vas or leakage through the vas if a stitch was passed through as in Belfield's second operation.

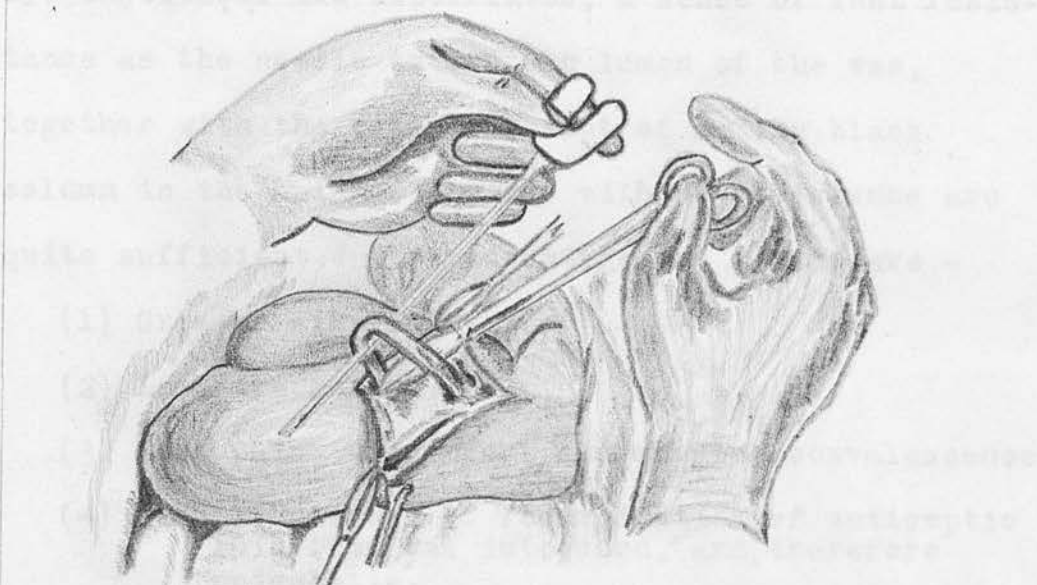
To test the potency of the vas he passes a 10" silkworm strand before passing the canula.

(c) Thomas "Vasopuncture"

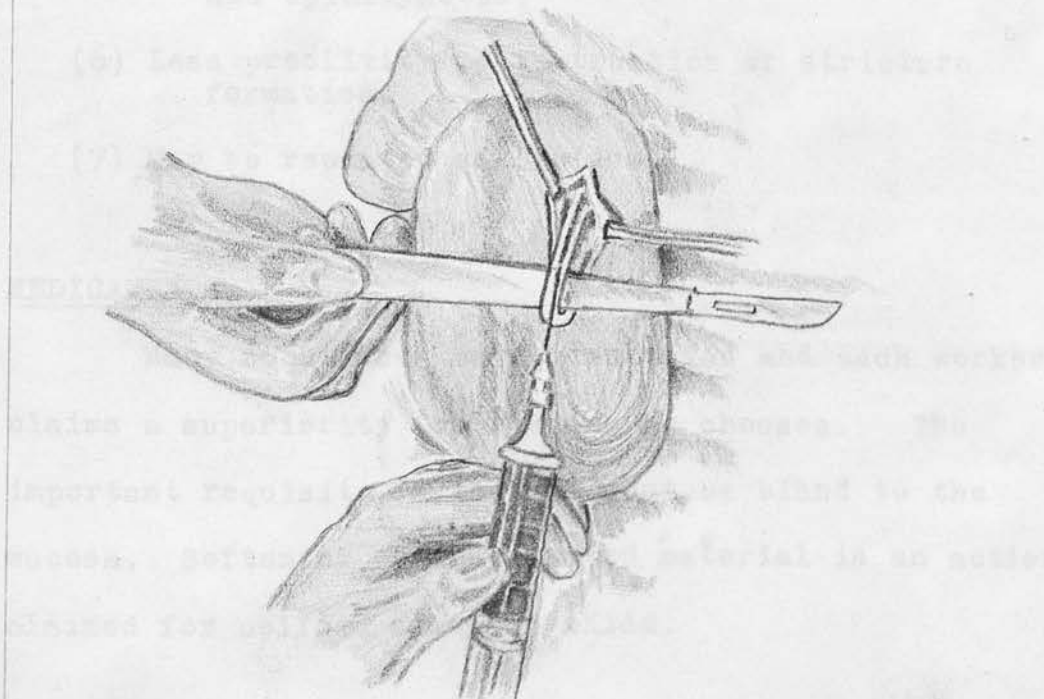
He exposes the vas the usual way and strips it of its fascial coverings. "The handle of the scalpel is slipped through the loop of the vas and slight traction made as the needle, No.19-21, of the special Record syringe is cautiously introduced, eye downwards, at the level of the edge of the handle of the scalpel.



The vas presented and fixed with Backhaus clips encircling it through its fascial investments.



Divestment of fascial sheath of the vas.



Vas out on the stretch preparatory to insertion

A few cubic centimetres of sterile water, or if desired a watery solution of inulin on one side and carmine on the other, may be first injected to determine the potency of the vas and ejaculatory ducts, by massaging the urethra, having the patient void urine or by using an in-lying catheter to detect the presence of the injected dye. As a matter of fact, with experience, the dye injections are superfluous, a sense of lost resistance as the needle enters the lumen of the vas, together with the visible ascent of a tiny black column in the axis of the vas without resistance are quite sufficient." The advantages he claims are -

- (1) Greater simplicity.
- (2) Less traumatism.
- (3) Less pain, discomfort and shorter convalescence.
- (4) Less likelihood of regurgitation of antiseptic fluid from vas into cord, and, therefore funiculitis.
- (5) Decreased possibility of intercurrent infection and epididymitis.
- (6) Less proclivity to obstruction or stricture formation.
- (7) May be repeated ad libidum.

MEDICAMENTS.

Many substances have been tried and each worker claims a superiority for the one he chooses. The important requisite is that it must be bland to the mucosa. Softening of inspissated material is an action claimed for colloid silver by Kidd.

The most commonly used drugs are the organic silver compounds in watery solution in 5 - 10%. Other watery solutions are the mercurials and chlorazene.

Since a prolonged action is better than a mere transitory one, oily solutions were thought to be better. Lipsiodol and iodipin in vegetable oils were used by Belfeild and Rolnick but were found to possess certain disadvantages.

(1) They are virtually non-absorbable and therefore may remain in the vesicles for an indefinite time; 2 years in one case.

(2) By prolonged contact they may cause irritation and cicatrix formation.

(3) They possess a great viscosity and are very difficult to introduce.

They have found animal oils to be more readily absorbed. The following oily suspensions we found satisfactory:

(a) 10 grams Iodol in 40 ccs. cod liver oil.

(b) 10 " Thymol " 30 " " " "

In all the cases in this series Argyrol in 10% was used.

COMPLICATIONS .

Vasotomy is such a minor procedure that complications occurring at all greatly reduce its value as a method of treatment. The complications that are liable to occur are many, but the most of them are due to some fault in the technique.

I. Thickening of the Cord.

This occurred in two of the cases and on one side only. It should be noted that this complication is considered as it occurred by itself and unaccompanied by any other complication.

The importance of this thickening lies in the possibility of occlusion of the vas with possible sterility. The causes of occlusion following vasotomy are:-

(a) extensive dissection of the cord, the vas and its sheath.

(b) Destruction of the mucosa of the vas either by the chemical used or by denuding it in introducing the cannula.

(c) Infection of the wound with subsequent cicatrix. Rabuick examined a case of occlusion and found cellular infiltration in the submucosa while the mucosa remained healthy.

(d) Regurgitation from the vesicle into the

wound of some substance e.g. collargol, which, while harmless to the mucosa, provokes in connective tissue a cicatricial formation.

In the technique, the indwelling cannula is considered as a foreign body liable to cause fibrous tissue by virtue of its constant irritation.

The question of sterility following vasotomy has not been done in this group of cases for one or other reason.

(a) Many cases were acute and thus could not be subjected to a preliminary examination for detecting spermatozoa.

(b) In all cases the vas was patent during the operation. After recovery those questioned were found to have normal sexual function.

(c) No case of bilateral thickening was encountered and therefore it might have been impossible to tell whether an obstruction has occurred if the other vas continued to discharge spermatozoa.

Belfield had 8 cases of vasotomy done on patients with one testicle. In all spermatozoa in abundant numbers were obtained.

Jenner following some of his cases found that it took 6 - 9 months for the vas to become patent again. He advocates diathermy and massage to the site of the operation to prevent the occurrence of occlusion.

Lastly it is sometimes necessary to assure the patient that vasotomy and occlusion does not mean impotence. American surgeons also advocate resection and anastomosis of the vas in cases of occlusion.

II. Epididymitis.

One case developed epididymitis three days after the operation. But another case developed oedema and swelling of both scrotal tissue as well as epididymitis and testes. A third case developed testicular pain but unaccompanied by any evident pathological changes.

Though epididymitis has been reported by many workers yet Belfield does not believe it to be due to the operation. He says "Epididymitis does not, probably cannot result from the mechanical injury or from the ordinary chemical solutions." In this respect, however, the case of scrotal inflammation is of interest because the wound healed by first intention, the patient developed no temperature and signs of "toxicity" had that scrotal inflammation been due to a bacterial invasion unless it was of a very attenuated character. The condition, however, developed quickly on second day of operation. From these facts it has been attributed to a chemical inflammation due to regurgitated argyrol up the vas, leaking out into spermatic tissue, into the tunica albuginea and causing both the scrotal inflammation and the epididymitis.

The causes of epididymitis after vasotomy are:-

- (a) Trauma of operation.
- (b) Chemicals regurgitating up the vas.
- (c) Infection of the wound.

In connection with fluids regurgitating up the vas, where the vesicles are infected, is generally accepted as the route of infection. The lymphatic route is considered possible by most urologists although as in the case of the ureter the lymphatics seem to be segmentally represented. Rolnick from experiments on dogs where he injected coloured fluid towards the vesicle failed to get the fluid past the tail of the epididymis. He considers the sheath of the vas as the probable route.

III. Extravasal Injection.

This is possible through

- (a) Failure to distinguish the sheath of the vas.
- (b) Puncture of the vas by the sharp end of the needle after its introduction into the lumen.

IV. Spermatic Fistula as in Kidd's case.

V. Perivesicular abscess - Kidd.

VI. Rupture of the vas by forceful injection in cases of occlusion.

VII. Atrophy of testicle.

VIII. Gangrene of testicle.

IX. Haematoma at the operation site.

None of these rarely reported complications were

seen. It seems therefore that with proper technique no complications should follow vasotomy. It is doubtful, however, that any group of cases can be done without the occurrence of one of the complications encountered in this group.

RESULTS .

Taken in general the results obtained can be considered as

6 good results.

4 Doubtful.

3 Definite Failures.

This accords with the results of Mark who claims 40% cures, 50% improved and 10% failures. It is important to note some other routine measures have been employed before, and in most cases after the operation as well.

Kidd claims 80% cures in a period of three weeks. Wolbarst and Belfield claim the same results in general.

The average stay in hospital varied from 3 - 15 days. Majority of urologists recommend a stay of at least 5 days, while others do the operation as a consulting room, or better, "office" procedure.

Two cases needed and had no other treatment. The iritis which was very much improved before the operation. The second a recurrent urethritis where irrigations were also stopped and the patient made a good recovery.

Ten cases required routine measures as well as special methods, like diathermy, were required in some of the arthritis cases.

One case required cauterisation of follicles.

If grouped according to their most important symptoms the cases can be classed and studied as follows:

(A). Arthritis.

Four cases were treated. Two were acute and two were chronic cases of gonorrhoea.

One had acute arthritis of knee and elbow. He responded well and was apparently cured one month after operation.

The second acute arthritis also had keratoderma. He made no response to the operation. Diathermy was employed. X-rays one month after the operation still showed evidences of arthritis. Two months he was transferred to another centre and still requiring treatment.

The chronic cases were two in number.

One was a complete failure in that the patient 9 months after the operation is still attending for treatment. His complement fixation is still positive and his left knee shows slight degree of effusion and is slightly painful.

The second chronic case is an apparent cure. The patient was discharged cured. This patient, however, had his teeth removed before the vasotomy was done, and how much that contributed to the cure is difficult to tell.

Such results of not more than 50% cure, and

certainly 50% failures, cannot be claimed as good.

Kidd reported 7 cases of arthritis in a group of 25 cases. He says "Seven of the cases suffered from obstinate and crippling arthritis. They were all cured in three weeks, and their joint troubles simply melted away." He goes so far as to say that the joint swelling, pain, etc. simply disappear in a miraculous way almost as soon as the patient recovers from the ether anaesthesia.

Wolbarst considers vasotomy the most dependable single measure and says that no case of arthritis can be cured without this operation; a view to which most will take exception.

Lowsley also states that it is an essential part of the treatment in association with antogenous vaccines. Belfield and many other American urologists express the same view.

Freiberg comments on the operation and expresses his opinion by saying "It not only should not be possible but I do not think that it is possible." Certainly gonococcal arthritis is one of the best examples of focal infection, but at the same time to expect that there will be recovery simply by attacking the focus is somewhat optimistic. If it is not possible to cure the vesiculitis without doing all kinds of things to it in loco, why should it be possible, simply by treating the vesicle, to cause the joint to clear up?

Treatment by conservative measures gives good results in the vast majority of acute cases. In chronic cases which are resistant to all other forms there may be a field for vasotomy if the vas is still patent, the vesicle still infected and the medicament can be got into the vesicles. If the joint shows destructive changes it is difficult to see how vasotomy can cure it and if it does, how in three weeks.

Admittedly one acute arthritis responded well though not dramatically. Lees in a study of over 300 cases says "In our experience vasostomy and vasotomy have not resulted in the spectacular cures claimed by those who advocate the operation; we have seen cases of arthritis on whom the operation was performed by others without any appreciable improvement and certainly without cure. In three of our sub-acute cases (not of this group of cases) vasostomy was performed and instillations of collargol were made into the vesicle, but failed to effect a cure of the arthritis or the gonorrhoea. We have also had under our care cases operated on by others with moderate results."

Lastly Parmenter's observations are of interest. He examined 14 cases of arthritis with previous gonococcal history and with the usual signs of prostatitis and vesiculitis. Cultures were made after prostatic massage. 8 were sterile, 3 showed staphylococci, 3 B.Coli and one streptococci. All showed other foci

of infection especially in the naso pharynx. After these foci have been removed the arthritis of ten very promptly cleared up. two improved and two showed no change. Treating the vesicles and prostate now they cleared up quickly. The point is that many of these patients have gonorrhoea as a starting point and as is well known the gonococci tend to die out and may be replaced by other infections which probably come from other foci in the body, and until these are eliminated it is difficult to cure the arthritis or the vesiculitis.

(B) Urinary Symptoms Group.

Four chronic cases had recurrent discharges usually following alcohol or coitus. Two had attacks of colic, possibly vesicular, and one had a sub-acute epididymitis and B.Coli urinary infection.

All patients benefited by the operation. The one least benefited and considered a failure is the B.Coli infection. The other three were all cured from both discharge and colic. They all had long treatment beforehand and the operation can be considered successful in these cases.

It seems that this type of case is the one most suited for vasotomy. The history and clinical features pointed to infection within the vesicles. The colic if considered as vesicular may be taken to indicate a wall still capable of spasmodic efforts and therefore

not densely thickened nor surrounded by marked fibrosis. They belonged probably to type I or II of Dillon and Blaisdell's descriptions of a cystic vesicle.

Two acute cases had repeated relapses of gonococcal Urethritis. One recovered in 5 weeks with no other measure. The other follicles were missed and the operation failed but the patient was cured after cauterisation.

(C) Iritis.

One case of recurrent iritis was treated. He responded well and has passed through the winter months, especially February, without a relapse. It cannot be affirmed whether the cure is going to be permanent.

Recurrent Iritis is probably the most difficult to deal with. Kidd had a case of iritis and joint trouble treated by vasotomy. He says "The operation sterilised the vesicle but a few months later he had another attack of iritis. This leads one to believe that iritis is in a different category to other gonococcal metastases. I believe that attenuated gonococci or their poisons get into the iris and live there indefinitely, so that it is not sufficient merely to sterilise the vesicles of gonococci to get a cure of the iritis. I doubt if gonococcal iritis is ever cured - that is to say rendered free from any possibility of relapse!"

(D) Acute Epididymitis.

He responded fairly well and was apparently cured in five weeks.

The epididymitis required the use of hot applications for a few days. The operation of epididymotomy has not been tried on any of the patients.

(E) Subacute Vesiculitis.

One patient after repeated attacks of gonorrhoea that often relapsed and that developed almost every complication, had a vasotomy done for the acute vesiculitis. He developed a very acute epididymitis three days after it and required months before he was cured.

OTHER SURGICAL MEASURES.

I. Catheterisation of Ejaculatory Ducts.

This has been advocated by Ritter and McCartney, Ruys and Valverde. The technique of vesiculography which at first appears simple, is in reality quite difficult in practice. In order to catheterise the ducts one must take into consideration their visibility, position, form and degree of permeability.

In normal conditions the position is variable, as was mentioned in the anatomy of the posterior urethra. This, as well as their form, is greatly altered by disease. In chronic vesiculitis with its accompanying posterior urethritis and vesumontanitis, the presence of congestion and oedema, of hypertrophy of mucosa or even polypi makes the procedure not only difficult but often impossible. The folds of the urethral mucosa often simulate the duct openings. They in turn are congested and at times sclerosed. Their degree of permeability is usually sufficient since in most cases they still have to allow thick secretions to go through. As judged by the vasotomy cases, in no one case were they blocked. X

If the vesicles are to be medicated at all then it is easier to do so by way of the vas, which has the advantage of medicating the ampulla.

II. Vesiculotomy and Vesiculectomy.

Many American surgeons still advocate the operation of Fuller and Cunningham of draining the vesicles or excising them through the perineum. This has not found favour with most other urologists.

The operation of vesiculectomy which leaves the patient sterile is one of great technical difficulties through working in a very confined space at structures very deeply placed. It is not devoid of danger to life and at best demands a lengthy convalescence. As practised in America it is combined with prostatotomy. Vesiculotomy aims at opening up the pouches and diverticulae of the vesicles and thus promoting drainage.

Impartial thought relative to these operations is bound to raise a number of pertinent questions.

(1) In view of the anatomical considerations is it possible by vesiculotomy to drain every focal abscess in the infected spermatic tract, especially if the incision is made in the dark or by the sense of touch? Is it not more likely that a few foci will be left to perpetuate the infection?

(2) Granted that a prostatitis is always an associated lesion, is it logical simply to drain the vesicles and ignore the infected prostate?

(3) Since the vesicles are considered analogous to the Fallopian tubes and called the "male pus tubes", is it correct and proper to drain or inject the one

while insisting on removal of the other? Would not radical removal, if thought necessary and justifiable, be the better practice? It is of course considered by most urologists an unjustifiable procedure. No record of vesiculectomy is found in the V.D. department.

When is vasotomy to be done?

This most important question curiously enough is left entirely unanswered by most urologists who advocate the operation. Albert Jenner, a supporter of vasotomy, writes -

"It seems to me there is a proper time when this method of vasopuncture should be undertaken. I am sorry not to hear any discussion as to what is looked upon as the proper time in chronic cases to do this operation. I have a feeling that it is when the urethra is free of gonococci and bacteria and you are getting practically sterile cultures and getting nearly leucocyte free smears from prostatitis secretions that this operation should be done."

If such are the criteria advocated, it becomes difficult to say definitely why it should be done at all. If the patient is bacteriologically free and prostatic smears, which really are prostatitis-vesicular, are negative for pus cells then certainly vasotomy would accomplish a cure in 100% of cases. One might say they were cured before the operation was done. It

seems that if done in such cases then it is just a final "bactericidal wash out" to the vesicles.

It is this difficulty of defining with any exactness the time to do the operation that makes assessment of results so difficult and also so variable. One case described here, that of iritis, makes a good example. This patient was very much improved clinically before the operation was done. After it, of course, he remained quite fit and free from iritis. It can be considered as a successful result. The benefit is attributed to the operation and possibly without enough justification.

In the cases studied, the acute ones had the operation done as soon as was decided upon, i.e. a few days after admission. In the chronic cases, however, there were both clinical and other findings indicating that the vesicles are still infected. There has been no special time for doing the operation. The only point is that when a decision was made that the patient has had a fair amount of routine treatment and showed little or no response.

Dillon and Blaisdell state that one vesicle may be markedly involved in the most advanced degree of vesiculitis and perivesiculitis while its fellow may be normal or involved only to a slight degree. When judging on clinical grounds it is felt that if one vesicle is palpably involved then its fellow is under

grave suspicion. If vasotomy is considered indicated then it should be done bilaterally as in most of the cases mentioned here.

Kidd, however, differs from most other urologists when he says - "Should one do both sides as a routine or only that side on which the vesicle can be felt? If in any doubt it is better to do both sides. Where it is quite obvious that only one side is at fault it is only necessary to do that side." He operated on one side in 11 cases and on both sides in 14 cases.

Of the 13 cases done only one had a unilateral vasotomy. A second patient had the two sides done on separate days with an interval of two weeks. The remainder had bilateral vasotomy done at one sitting.

The use of vaccines, especially the polyvalent non-detoxified variety, is followed by good results in most chronic cases and most cases of arthritis or other complication. The one that has been used in treating patients in this series of cases is arthigen - a polyvalent vaccine in sterile water solution and given intravenously.

The chemotherapy of chronic or acute gonorrhea has until recently been a matter of controversy as to the efficacy of one drug or another. Methyl mercaptopyridine and other ars compounds, gonacrine and other oxidizing preparations have from time to time been found very useful by some and never or another.

OTHER METHODS OF TREATMENT.

The results of vasotomy, as has been shown, are not always good. In the majority of cases treatment by more conservative measures attains a cure though at times it needs months of patient and careful attention to general hygienic and dietetic rules by the patient.

The more usual measures used are irrigations and instillations into the anterior and posterior urethra. The use of instruments and dilators followed by mild irritation in the form of instillations of silver in some forms, especially the nitrate. Prostatic and vesicular massage and the use of vaccines and Chemotherapy and some forms of heat therapy.

The use of vaccines, especially the polyvalent non-detoxicated variety, is followed by good results in most chronic cases and most cases of arthritis or other complication. The one that has been used in treating patients in this series of cases is arthigon - a polyvalent vaccine in sterile urotropin solution and given intravenously.

The chemotherapy of chronic or acute gonorrhoea has until recently been a matter of controversy as to the efficacy of one drug or another. Hexyl resorcinol, pyridium and other azo compounds, gonacrine and other acridine preparations have from time to time been found very useful by some observer or another.

I have had the opportunity of observing many cases of gonorrhoea treated by the use of gonacrine. Fifty cases that had fairly large and regular doses, both intravenously and by mouth, have been analysed and compared with cases of a similar kind where no gonacrine was given. A comparison of the two enables one to state that at least in those fifty cases the drug did not achieve any appreciable results. The total duration of treatment was not curtailed, the incidence of complications was not diminished, while some complications due to the drug were noticed. One case developed jaundice and two cases had gastro-intestinal upsets which were severe enough to cause vomiting on more than one occasion. The jaundice and gastro-intestinal troubles cleared up well on cessation of the drug. It should be mentioned also that all the patients were subjected to the same routine treatment.

Of more recent date is the use of sulphanilamide preparations - e.g. paramino benzene sulphonamide or its acetyl derivative. They have been introduced after these cases of vasotomy were done and have been in general use now for a few months.

The general opinion regarding these drugs has so far been very favourable. Some patients, however, do not derive much benefit from their use, their number is in the region of 25-30%. In the remainder of

the patients it reduces the length of treatment and also gives one the impression of reducing the complications. Already certain toxic effects have been observed to occur in many patients from the administration of sulphanilamide. It is important to determine whether these reactions are due to the inherent toxicity of the drug or examples of real idiosyncrasy. Will sufficiently large doses of almost any drug which cause toxic manifestations in all persons. In a few cases this response is produced by small therapeutic doses.

The cerebral symptoms - dizziness, nausea, headache and confusion - as well as acidosis and cyanosis have been observed and appear to be direct toxic effect of the drug. Acute haemolytic anaemia and the possible agranulocytosis must at present be considered as idiosyncracies. Too little is known about the fever and skin rashes to attempt to classify them at present.

In dogs acidosis is produced by large doses of the drug, and found to be due to an alkali deficit. The very alkaline urine with coincident loss of very large quantities of bicarbonates and base certainly plays an important part in the production of acidosis and may be the main cause. It is possible that it may be due to lack of reabsorption of bicarbonate and base from the glomerular filtrate, the reabsorption of a large amount of the filtered sulphanilamide interfering with that of the bicarbonate.

It may be too early to speak of the value of this method of chemotherapy, but at any rate for the present it seems to supplant most other measures. In future it may so affect the results that vasotomy will not be needed, or if it is, then the number of patients needing it will be very much smaller.

Lastly the value of heat and the bearing of the more recent advances in this method of treatment will be mentioned, as it will be seen from the published results that it greatly affects the treatment of the more chronic and resistant case. Heat has been used to imply all measures of producing increased temperature either locally or throughout the body.

The value of local heat in treating gonococcal infections of the more deeply situated structures has long been known. The present day routine measures of hot hip baths and hot rectal douches and hot applications and irrigations are the simplest forms. The more elaborate forms by diathermy and the use of special applicators has been reserved for the more resistant cases. Because of the constant cooling action of the circulating blood it has been difficult to maintain an effective local hyperthermia without fear of injury to the sensitive tissues. The attempts at local thermotherapy have therefore shown some very good results and some very disappointing ones. They are still very largely used as adjuvant methods of treatment and

certainly have the value of giving at least temporary relief of the more acute symptoms.

In the past many physicians have observed the beneficial effect of fever on gonorrhoeal infections. Finger, Ghon, Schagenhauser could not induce urethritis by injecting gonococci into the urethra of a patient whose temperature ranged between 39 and 40°. Other investigators noted that gonorrhoea was inhibited, subsided or disappeared after and during acute infections, fevers, pneumonia, mumps, and malaria. Berg Green in 1933 reported his experience with 233 cases of chronic gonorrhoea treated with malaria in the last few years, and concludes that it is useful but not without danger. He obtained cure in 90% of the men and 85% of women in an average of 36 and 55 days respectively. These were all stubborn cases. Hasegawa, Murata and Usui reported similar results.

General elevation of body temperature has been employed in many cases of the chronic cases, in some with good results, in others with moderate or no effect. This has been achieved, however, by use of chemicals or vaccines. The drugs usually used were Aolan, a sterile, toxin-free solution of lactalbumen, and contramine a sulphur preparation - diethyl-ammonium diethyl-dithio-carbamate - and arthigon.

Recent work on the determination of the effects of temperature on the gonococcus in vitro has yielded

very significant results. In 1926 Corbus and O'Connor reported that at 45° the gonococcus is killed instantly.

The most careful investigations on the thermal death time of the gonococcus were made by the Rochester group of workers, Carpenter, Boak, Mucci and Warren. Their results have important biological and therapeutic applications. They determined the thermal death time of 130 strains of *Neisseria gonorrhoea* and found this to vary between 6 and 23 hours at 41.5° . At 39° the growth was not appreciably affected. At 97° 976 were killed by 10 hour exposure. At 99° 996 were killed in 4 to 5 hours. They used a 48-hour glucose ascitic fluid broth cultures of 2nd or 3rd subcultures. These were previously found to be the most resistant. 97

From these studies it became apparent that it would be possible, in most instances, to exceed the thermal death time of the organism without injury to the human host.

Following their primary investigations, these physicians ascertained the thermal death gradient of the specific gonococcal strain infecting a patient about to be treated by a preliminary in vitro experiment. They then subjected each of eleven patients to a single fever session of 41.5° equal in length to the thermal death time of his culture. There was an immediate subsidence of all clinical symptoms and a bacteriologic cure. Similar results were obtained in nine other patients when a fever equal to $\frac{3}{4}$ the thermal

death time was produced. This suggests that other defence mechanisms, such as specific antibodies, are actively assisting the body to eradicate the gonococcus.

It seems certain that if the same temperatures are maintained for an equal time interval in vivo and in vitro, a given strain of gonococci will be more easily destroyed within the body than when heated in a test tube. This method of temperature control would seem to be an ideal way were it not for two factors. First the difficulty of the first determination and second the harrowing experience that the patient may then have to undergo.

The method of production of this artificial hyperthermia is by heating the body by putting it in an electro-magnetic field of sufficient intensity, till the temperature is raised to the required level of 41.5° . It is kept there by a special air-conditioned cabinet for the required period. The use of blankets with consequent sweating allows the penis to retain a temperature 1.7° below that of the rectum and may thus account for some failures in treatment.

Results obtained by various workers in gonorrhoea and gonorrhoeal arthritis are tabulated below. X

I. Acute and Chronic Gonorrhoea.

From the published results of twelve authors the following was compiled:

590 cases were treated.
 464 or 79% were cured.
 29 or 5% were improved.
 95 or 16% were unimproved.

These results of almost 80% cure in patients who had no other method of treatment, - many were chronic cases and more than half were females - are very imposing. If the question of inefficient therapy of too short a period or too low a temperature is considered, the results become more impressive.

II. Gonorrhoeal Arthritis:

From 18 authors:

270 cases were treated.
 216 cases were acute.
 54 cases were chronic.
 179 or 66% cured.
 64 or 24% improved.
 27 or 10% very slight or no improvement.

There is generally more agreement as to the results in arthritis cases. The value of pyretotherapy in non-gonococcal arthritis is undoubted. In gonococcal cases even better results are obtained.

What are the drawbacks?

- (1) It is time-consuming and very expensive.
- (2) It requires hospitalisation in a condition that is essentially and must be kept as ambulatory as

possible. In working class people interference with work may mean a great hardship.

- (3) It is highly complicated in that a specially trained bacteriologist is needed.
- (4) Three deaths have been reported. This though occurring in cases treated by external heating does not sound favourable, especially when one considers that the original ailment carried no risk to life.

From the accounts published one feels, however, that this treatment has a very definite place in our armamentarium. If with the more recent methods of fever production, the risks or accidents are removed the method seems to hold its place for the more recalcitrant cases of infection in deep structures such as vesicles and tubes. There is no need to make it the only method of treatment, except for experimental reasons.

CONCLUSIONS.

- (1) The urethra bears the brunt of gonococcal infections. It is favoured by better drainage and constant flushing with urine as compared to the seminal vesicles.
- (2) In the urethra, structures more recently acquired morphologically, like Littre's glands, are more prone to chronicity. They were developed originally as accessories to the seminal tracts.
- (3) The lymphatics from the urethra possibly play an important role in the extension of infection to the vesicles. This can be considered as an argument against the rationale of vasotomy.
- (4) The incidence of vesiculitis based on clinical grounds has been found not to exceed 30% in a large number of cases of gonorrhoea.
- (5) Many of the cases exhibited no acute stage.
- (6) The time of occurrence is difficult to ascertain. It was found that the more protracted the case, the more likely are the vesicles to get involved.
- (7) No evidence was found to support the estimates of Belfield and Wolbarst that the majority of cases develop vesiculitis and that during the first month.

(8) In chronic cases, the term vesiculitis gives the impression of a localised lesion. It is better to use the term "genital tract infection", in particular when thinking of treatment.

(9) The symptomatology may be complex and cases liable to be wrongly diagnosed.

(10) The pathology of vesiculitis throws great doubts on the value of vesicular medication.

(11) Evidences of filling of the vesicles have been found lacking in many cases despite successful injection at the time of operation. The impression one gains is that the drug passes to the urethra at once in many cases.

(12) The rationale of vasotomy is better based on its ability to promote drainage than on the supposed action on gonococci of the chemicals used.

(13) Because of the associated prostatitis, vasotomy is probably irrational in acute cases. Furthermore the majority of cases recover quickly with simple measures.

(14) In acute gonococcal arthritis it does not give the dramatic cure as claimed by its protagonists.

(15) In chronic cases, the more healthy the wall of the vesicle, the better is the prospect of success of vasotomy.

(16) In these chronic cases the value of the operation has been overrated. The results obtained do not justify the enthusiastic claims for it. It very often fails and may be accompanied by complications.

(17) The more common complications are thickening of the cord and epididymitis. This latter does occur without wound sepsis.

(18) Other surgical methods of treatment have not been favoured in this country and do not seem to offer any better results than conservative measures.

(19) For success the urethra and other parts of the urogenital tracts must be carefully examined to exclude the presence of other lesions that demand treatment as well.

(20) In view of the more recent development of chemotherapy and its possible value in decreasing the incidence of vesiculitis in general, and in view of the possible future development of artificial fever and thermal therapy for the treatment of more resistant cases, it seems probable that vasotomy will be unnecessary, even the so-called "bugbear" cases.

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